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LEVEL OF JOURNALS AND EVALUATION OF RESEARCH IN ENVIRONMENTAL SCIENCES IN BRAZIL

Nível dos Periódicos e Avaliação da Pesquisa em Ciências Ambientais no Brasil

Nivel de Revistas y Evaluación de Investigación en Ciencias Ambientales en Brasil

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ABSTRACT:

Ranking journals of science has been a common way of evaluating graduate programs and scholars. A feeling that journals of Humanities and Social sciences have a lower probability than others in attaining top levels is also quite recurring. Analysis of journals` ranking where papers are published sheds light on this issue. Data taken from 4,422 journals of Environmental Sciences, which covers most areas of knowledge, available at the Qualis system of the Sucupira Platform of the Ministry of Education in Brazil, from 2013 to 2016, show that there is an unequal ranking of journals in the scale of the Qualis system, and that chances for Humanities and of Applied Social Sciences journals being at the three highest levels are lower than for other main areas. A way of reducing disparities and improving meritocratic criteria in research evaluation is discussed.

Keywords: Research evaluation; Bibliometric indicator; Areas of knowledge; *Qualis* system.

RESUMO:

A avaliação da produção científica por meio da qualificação dos periódicos tem sido utilizada para qualificar programas de pós-graduação e docentes que atuam nos programas. O sentimento de que os periódicos têm baixa probabilidade de atingir os níveis mais elevados na escala do sistema Qualis, no caso das publicações das áreas Humanas e Sociais Aplicadas. Uma análise do ranking dos periódicos por área do conhecimento pode lançar luz sobre este assunto. Para tanto, foram analisados 4.422 periódicos das Ciências Ambientais, que abriga quase todos os campos do conhecimento, disponível no sistema Qualis, da Plataforma Sucupira/CAPES, do período 2013-2016. Os resultados mostram que periódicos associados às áreas Humanas e Sociais Aplicadas têm menos chances de estarem entre os níveis mais elevados da escala, quando comparados com outras áreas. Discute-se uma estratégia para reduzir as disparidades.

Palavras-chave: Avaliação da pesquisa; Indicador bibliométrico; Áreas do conhecimento; Sistema Qualis.

RESUMEN:

La evaluación de la producción científica por medio de la calificación de los periódicos ha sido utilizada para calificar programas de postgrado y docentes que actúan en estos programas. Un sentimiento de que los periódicos tienen baja probabilidad de alcanzar los niveles más elevados en la escala del sistema Qualis, para publicaciones de las áreas Humanas y Social Aplicadas, es también común. Un análisis del ranking de los periódicos puede arrojar luz sobre este asunto. Los dados de 4.422 periódicos de las Ciencias Ambientales, que alberga casi todos los campos del conocimiento, disponible en el sistema Qualis, de la Plataforma Sucupira/CAPES, del período 2013-2016, muestran que los periódicos asociados a las áreas Humanas y Social Aplicadas tienen menos probabilidade de estar entre los niveles más altos de la escala, en comparación con otras áreas. Se discute una estrategia para reducir las disparidades

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Palabras-clave: Evaluación de la investigación. Indicador bibliométrico. Áreas del conocimiento. Sistema Qualis.

1 INTRODUÇÃO

Research evaluation through ranking journals in each field of science is a way of evaluating graduate programs and scholars in many countries, including Brazil, where pervades a feeling that researchers of the Humanities and Applied Social Sciences face difficulty publishing in highly qualified journals. Such a difficulty may be explained, in great extent, by the existence of a lower probability of such journals in their field of knowledge, comparing to other areas.

The analysis presented in this paper focuses on the hypotheses that there is a disproportionate distribution of journals among the eight levels of the Qualis system scale, and of a strong relationship between area of knowledge and ranking journals in each area. Additionally, we analyze the effect of different areas of knowledge on ranking journals at the top or at the bottom of the Qualis ranking scale. For decades, science has looked upon publication and citation counts as indicators of productivity and eminence. A paper by F. Cole and Nellie Eales, in 1917, on the history of science, is considered one of the earliest bibliometric papers to be evaluative in nature, and P.L.K. Gros and E.M. Gros suggested, for the first time, in 1927, that citation counts be used as a measure for a college library's adequacy (NARIN, 1976).

Scientific journals became one of the main sources to evaluate graduate programs, promote individual researchers, and rank academic institutions or research centers. It has been argued that the evaluation of scientific publications assures quality development and improvement in science (Costa and Yamamoto, 2008; Hicks et al. 2015), and can be used as a tool for auditing researchers and distributing funds (CHAVARRO et al., 2017).

Since 1990, there has been a strong proliferation of research assessment due to "increasing pressure for accountability" (WHITLEY and GLÄSER, 2007). Most of these assessments are based on a journal's classification of a quality ranking that uses internationally accepted criteria and indicators, on the assumption that such rankings are mechanisms that avoid subjective criteria and political influence on public resource distribution for academic projects. It has been argued that this procedure is a way of protecting against injustices or distorted decision-making (ALVES, 2016; RÀFOLS et al. 2016). However, particularistic variables such as the country where the journal is published, discipline, and language have also strongly influenced the recognition of a high-quality journal (CHAVARRO et al., 2017).

Bibliometric indicators have also been used under the assumption that when a paper is published in a mainstream journal there is an assurance that the produced science will have an international recognition. This assumption reinforces the universalism of produced knowledge and science definition in force, according to Silva and Mueller (2015), inspired on Bourdieu`s (1976) analysis of the scientific field.

Practices of defining criteria and indicators valid to all scientific fields for international generalizations should be seen as restrictive because they do not take into consideration the specificities

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of each area of knowledge (SILVA and MULLER, 2015). Despite recognizing the powerful influence on the production of knowledge exerted by academic evaluation, Bianco et al. (2016) argue that evaluation based on universal criteria, without taking into account the social context in which they are applied, produce negative signals to scientists willing to conduct research on contextualized agendas. Local agendas are very important and should not be underweighted.

In spite of the acceptance of the need to improve the ways in which the outputs of scholarly research are evaluated (DORA, 2012), there is an awareness that research evaluation plays an important role for science development (Hicks et al., 2015).

The first studies on scientific communications were completed in the seventies in Brazil, though concerns about setting a metric basis to evaluate the quality of scientific papers in the country began in the sixties. Nowadays, funding agencies such as CNPq – the Brazilian National Council for Research – give support to journals that are at the four highest levels of the Qualis system (FRIGERI and MONTEIRO, 2014).

Scientific production is one of five criteria considered by the Qualis system of CAPES - Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – of the Ministry of Education (MEC), and responsible for quality assurance in graduate programs in Brazil – the most important item to date, in evaluating courses, graduate programs, and individual scholars working on those courses and programs. Special attention has been given to ranking journals that publish papers. In general, grades received by courses, programs, and faculties affect resource distribution from governmental institutions for research support and fellowships to teachers and students.

Brazilian officials have issued some rules to avoid or reduce inequalities in the evaluation system between researchers of different fields of knowledge. CAPES sets the scale of the Qualis system in the country for that purpose. Such a scale has eight levels - ranging from A1, the highest level, to A2, B1, B2, B3, B4, B5 and C, the lowest level – which takes into account the weighted average of qualified publications per scholar, weighted by the journal where the paper is published. The Scientific Technical Council for Superior Education (CTC-ES) of CAPES sets criteria for journals distribution in the Qualis system scale as follows: number of journals in strata A1 and A2 should not exceed 25% of total journals for a specific area of knowledge, and A1 journals should be less than A2. Additionally, summation of the three highest strata (A1, A2 and B1) should not exceed 50% of the total Qualis system scale, without taking into consideration stratum C (CAPES/MEC, 2013). It has also been set that papers published in journals of level B3, B4 or B5 should be considered 20% only, what allows one to expect that no more than 20% of journals would be at those levels (CAPES/MEC, 2016a). Putting together, those criteria produce a theoretical quasi-normal distribution of journals in the scale of the Qualis system for Environmental Sciences as in Graphic 1.

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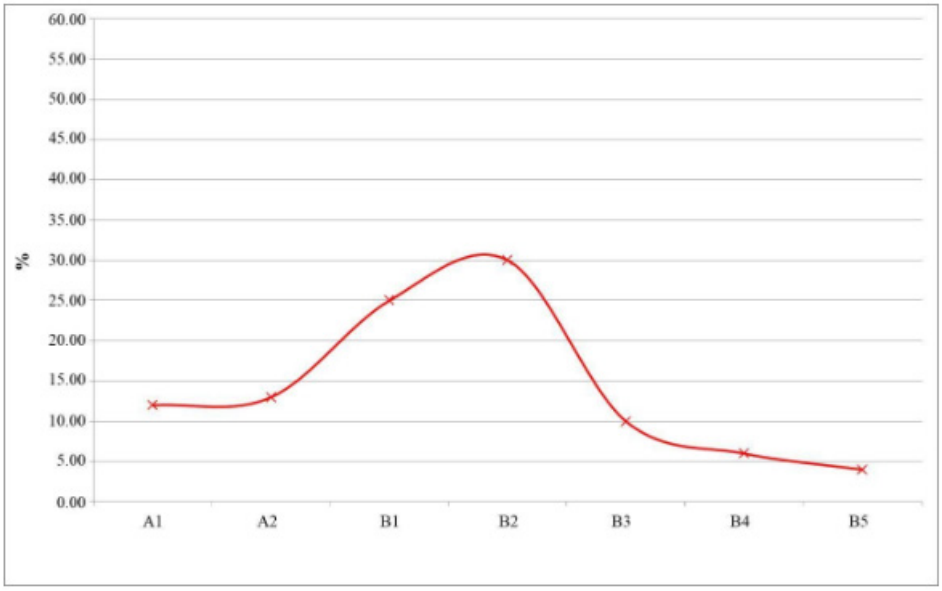

Graphic 1: A theoretical distribution of journals in the scale of the Qualis system for Environmental Sciences. **Source:** Org. by authors.

This trend of associating resource distribution for educational or research institutions with an amount of points supposedly free of subjective evaluations and political intrusion is a phenomenon that has grown through several countries as a mechanism to give resources such as scholarships/ fellowships and support to research projects, to evaluate their performance, and to produce a national ranking of graduate programs, despite the weaknesses and flaws of bibliometrics as pointed out by scientific publications.

Indeed, it seems that the fight for the monopoly of scientific authority, defined as technical capacity and social power, is at stake in the scientific field, as Bourdieu (1976) argues. According to him, the universe of science, of most pure science, is a social field as any other, with power relationships, and monopolies, fights and strategies, and interests and gains, though with specific ways of fighting for the monopoly of scientific competence.

The Leiden Manifesto (HICKS et al., 2015:429-430), in spite of recognizing the importance of research evaluation for scientific development and its interaction with society, sets forth a concern regarding risks due to "pervasive misapplication of indicators to the evaluation of scientific performance". It is also argued that "metrics have proliferated: usually well intentioned, not always well informed, often ill applied."

The Evaluation Methodology of the Czech research system (Good et al., 2015:92), for instance, is a "negative example of a performance-based research funding system" due to misapplication of indicators for research production evaluation. "In order to depoliticize and depersonalize decision-making ... a method to evaluate research and to allocate funding based on productivity ... has introduced considerable instability and unpredictability". Political influences on decisions for funding allocation became hidden behind numbers.

A few years ago, in 2012, editors and publishers of scholarly journals made an effort to improve the ways of scientific research evaluation. The outcome of that effort, known as The San Francisco Declaration on Research Assessment (DORA), was developed in that year during the Annual Meeting of the American Society for Cell Biology in San Francisco, CA (DORA, 2012).

Chavarro et al. (2017) argue that, despite mounting criticisms on the issue, research assessment based on a journal's quality continues to be a common practice in several European countries including Hungary, Russia, Poland, Spain, in South Africa, and in South America, including in Brazil,

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whose data are the concern of this analysis. It is argued that reasons for adopting research evaluation in certain countries may be for auditing researchers and distributing funds; but, according to Ràfols et al. (2016), managerial decisions based on such a criteria could be questioned.

Silva and Mueller (2015) argue that the Brazillian Qualis evaluation system is unable to evaluate the concrete quality of evaluated products. According to these authors, criteria for assessing the quality of productivity should be seen with restriction when attempting to generalize the criteria if they do not take into consideration the particularities and dynamics of each scientific field or discipline. According to Frigeri and Monteiro (2014), the Qualis system creates injustice when evaluating graduate programs and scholars because of discriminatory practices it produces among different fields of science.

Indeed, it is well known, among researchers, that the concept of science and procedures of doing science are dominated by natural sciences and engineering, and criteria to evaluate scientific production are created according to the understanding of those scientific fields. This conflict between different fields of knowledge is reflected in the difficulties researchers of some areas have in being well evaluated, particularly in the Humanities and Applied Social Sciences, when compared to natural sciences (Biology, Physics, Chemistry) and technological (Engineering) researchers. One may say there is a gap among fields of science which produces an uneven and unfair distribution of resources, and a latent conflict among researchers at the academia. As Bourdieu (1976) argues, distance between scientific fields reveals conflicts of interests around Science definition that dominant areas try to impose. Those tensions, indeed, are the expression of political fights surrounding the distribution of public resources between scientific areas.

Despite the given rules for journal distribution in the ranking system, our analysis in this paper was based on the hypothesis that researchers in the Humanities and Applied Social Sciences face difficulty publishing in highly qualified journals, in great extend, because of the reduced number of such journals in their field of knowledge.

The hypothesis of a disproportional distribution of journals has been suggested in a previous work (TREVIZAN and PASSOS, 2017), in which data in the Environmental Science field showed, for the period between 2013 and 2014, that for areas such as the Biological Sciences, Exact & Earth Sciences and Engineering, more than 30% of journals were at the top A1 or A2 of the journals qualification system, while for Humanities and Applied Social Sciences, no more than 12% of journals were at the top. In practice, therefore, journal distribution in the ranking system, at least in the Environmental Science area, does not follow what has been established by CAPES, except in the Humanities and Applied Social Sciences. Those findings may explain, in part, why teachers and researchers at the Humanities and Applied Social Sciences feel that it is so difficult to fulfill requirements of graduate courses, compared to their colleagues in other scientific fields, mainly Biology, Exact Sciences, and Engineering.

In this paper, we persist in the same hypothesis of disproportionate distribution of journals at the Qualis system scale, and go deeper to identify the relationship between areas of knowledge and the ranking of journals for each area of science. Additionally, we analyze the effect that different areas of knowledge have on ranking journals at the top or at the bottom of the Qualis ranking scale.

2 MATERIALS AND METHODS

The list of journals of Environmental Sciences used in this research, which represents all scientific fields, is available at the Sucupira Platform (CAPES/MEC, 2017). A total of 4,422 out of 4,715 journals, for the period from 2013 to 2016, have been analyzed. Journals with a C Qualis level were excluded, as they count zero in the CAPES evaluation.

For the sake of graduate programs evaluation, fields of science have been aggregated by CAPES into nine main areas of knowledge such as Agrarian Sciences, Biological Sciences, Health Scien-

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ces, Exact and Earth Sciences, Human Sciences, Applied Social Sciences, Engineering, Multidisciplinary Sciences, and Linguistics and Arts. Environmental Sciences has been set as one field of science of the Multidisciplinary main area (CAPES/MEC, 2016b).

In order to analyze the relationship between main fields of science and journals of the Environmental Sciences area, we have coded journals qualification in the Qualis system scale as binary variables, 1= Yes or 0=No, whether they do or do not belong to one of the above main areas of knowledge. We have coded Linguistics and Arts as Human Sciences. All these procedures have been repeated for each level of the Qualis scale.

We have adopted journal's title and publisher`s (Elsevier, Taylor & Francis, John Wiley and Sons, Springer and others) statement regarding journal scope, aims&scope or policies, available on the journal website (typically at the journal's Home > About > Policies/Scope/Aims&Scope page), to classify the area of knowledge a jurnal belongs to.

A test of independence (Ho) of journals distribution in the Qualis scale system by main area of knowledge has been performed using the Chi-square formula $\sum = (O-E)^2E$ with p .01.
Logit model parameters have been used, taking Qualis levels (from A1 to B5) as the dependent variable, and areas of knowledge as the independent variables (binary variables), not counting for interaction among variables (non-saturated model), as follows:

$$Ln(Qualis_{ij}) = Const. + B(Agrarian + Biological + Health + Exact\&Earth + Human\& \\ Applied\ Soc + Engineerings + Multidisciplinar\ Sci),$$

Where *i* represents the probability of occurring a Qualis level (A1, A2, B1, B2, B3, B4 or B5), as dependent variable, in each area of knowledge, represented by *j*. B represents the effect of each area of knowledge *j*, on the Qualis level *i*. The beta coefficient indicates the positive or negative effect of each independent variable on the dependent variable. The beta exponential of the natural log (e^b) expresses the multiple value effect of the independent variable on the dependent one.
In addition to the parameters of the regression logit model, *log linear modeling* has also been performed to obtain *odds-ratio* and *log-odds-ratio* from frequency or contingency tables, without defining a dependent variable, corresponding to e^b and Beta ($ln(e^b)$) parameters, respectively, at the logit regression model (FIENBERG, 1987; CHRISTENSEN, 1997; JEANSONNE, 2002; STATSOFT INC, 2013; GARSON, 2012).

In order to evaluate differences between two areas of knowledge, a 2 x 2 table can be used, through which one can obtain a cross-product or odds-ratio (FIENBERG 1987). In so doing, odds result from a Yes/No ratio or the probability of occurring "Yes" for each Qualis level at a specific area of knowledge. Odds-ratio = e^b is the ratio of two odds, that is, the multiple of times a specific area of knowledge gets a "Yes" answer, compared to another area of knowledge. Log-odds-ratio = beta or $\ln(e^b)$ indicates the direction (positive or negative effect) of one area of knowledge on a specific Qualis level.

3 RESULTS AND DISCUSSION

Table 1 shows that, when Environmental Sciences, as a whole, are taken into consideration, journals distribution at the Qualis system scale fit CAPES rules. That is, journals of the area that are at levels A1 or A2 do not exceed 25%, and those at level A1 are less that those at level A2. Besides, journals at levels A1, A2 or B1 do not exceed 50% of the total.

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Qualis Strata*	Absolute and Relative Frequencies	
	N°	%
A1	462	10,4
A2	602	13,6
B1	1177	26,6
B2	448	10,1
B3	348	7,9
B4	631	14,3
B5	754	17,1
TOTAL	**4422***	**100,0**

Source: Organized by authors from original data taken from the *Sucupira* Platform (CAPES/MEC, 2017).

* The total number of journals in the Sucupira platform for 2013-2016 period amounts to 4,715, when one takes into account the C stratum journals, though these journals were not taken into consideration in this research.

Table 1: Absolute and relative frequency of journals in Environmental Sciences in the Qualis system from 2013 to 2016 in Brazil. **Source:** Org. by authors.

However, when looking at different fields of knowledge inside that same area, unequal distribution of journals by level of the Qualis system scale becomes undeniable. The null hypothesis (H0) of independence of journal distribution by level of the Qualis scale among main areas of knowledge (Table 2) has been tested and rejected, using

$$\text{Chi-Square} = \sum (O-E)^2 E \ , \ \text{d. f.} = 36, \ p = .05 > 55.8 \ \text{(critical value)}.$$

Main Areas of Knowledge	Observed (and expected) frequency of journals by level of the *Qualis* scale							Total
	A1	A2	B1	B2	B3	B4	B5	
Human Sciences and Applied Social Sciences	19 (146,2)	50 (190,5)	259 (372,4)	171 (141,7)	256 (110,1)	370 (199,6)	274 (238,5)	1399
Engineering	66 (50,6)	65 (65,9)	132 (128,8)	57 (49,0)	23 (38,1)	64 (69,1)	77 (82,5)	484
Multidisciplinary Sciences	38 (32,4)	32 (42,2)	52 (82,5)	15 (31,4)	24 (24,4)	58 (44,2)	91 (52,9)	310
Exact and Earth Sciences	118 (57,8)	159 (75,3)	170 (147,2)	28 (56,0)	7 (43,5)	31 (78,9)	40 (94,3)	553
Health Sciences	58 (64,6)	89 (84,1)	162 (164,5)	150 (62,6)	13 (48,6)	49 (88,2)	97 (105,4)	618
Biological Sciences	133 (74,2)	185 (96,7)	256 (189,0)	18 (71,9)	16 (55,9)	32 (101,3)	70 (121,1)	710
Agrarian Sciences	14 (39,8)	45 (51,9)	177 (101,4)	11 (38,6)	11 (30,0)	29 (54,4)	94 (65,0)	381

Table 1: Observed (and expected) distribution of journals of the Environmental Sciences by Qualis levels and main area of knowledge of the Sucupira Platform, from 2013 to 2016. **Source:** Elaborated by authors from original data available at *Sucupira Platform* (CAPES/MEC, 2017).

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Human Sciences and Applied Social Sciences, together, count for about 5% of journals at levels A1 or A2, while Biological and Exact & Earth Sciences reach 45% and 50%, respectively.

Meanwhile, in the lower levels (B3, B4 and B5), Human Sciences and Applied Social Sciences reach 64%, against 17% and 14% in Biological and Exact & Earth Sciences.

Comparing Human and Applied Social Sciences with other areas of knowledge, based on the frequency table (Table 3), one can assert that:

- In Human Sciences and Applied Social Sciences, together, 5% (69/1399) of journals have Qualis A1 or A2, and 23% (328/1399) of journals have Qualis A1 to B1;
- In Agrarian Sciences, 15% (59/381) of journals have Qualis A1 or A2, and 62% (236/381) have Qualis from A1 to B1;
- In Biological Sciences, 45% (318/710) of journals have Qualis from A1 or A2, and 81% (574/710) of journals have Qualis from A1 to B1;
- In Health Sciences, 24% (147/618) of journals have Qualis from A1 or A2, and 50% (309/618) have Qualis from A1 to B1;
- In Exact and Earth Sciences, 50% (277/553) of journals have Qualis from A1 or A2, and 81% (447/553) have Qualis from A1 to B1;
- In Engineering, 27% (131/484) of journals have Qualis from A1 or A2, and 54% (263/484) have Qualis from A1 to B1;
- In Multidisciplinary Sciences, 23% (70/310) of journals have Qualis from A1 or A2, and 39% (122/310) have Qualis from A1 to B1.

In short, Exact & Earth Sciences and Biological Sciences are the areas that concentrate journals at the highest levels (A1 or A2) of the Qualis system scale, while the Humanities or Applied Social Sciences are the areas with the lowest percentage of journals at the two highest levels. These findings support de feelings that journals of the Humanities and Applied Social Sciences are discriminated against, comparing to other areas, in terms of journals distribution in the level of the Qualis system scale.

From Table 3, log-odds-ratios have also been obtained, which allow one to assert that, when journals of the Environmental Sciences area are taken into consideration:

- the probability of journals having Qualis A1 or A2 is .183/.052=3,519 times higher in Agrarian Sciences, .811/.052=15.596 in Biological Sciences, .312/.052=6.000 in Health Sciences, 1.003/.052=19.288 in Exact and Earth Sciences, .371/.052=7.135 in Engineering, and 292/.052=5.615 in Multidisciplinary Sciences, comparing to Human and Applied Social Sciences, taken together;
- the probability of journals having Qualis A1 or A2 or B1 is =1.627/.306=5.317 times higher in Agrarian Sciences, 4.220/.052=13.790 in Biological Sciences, 1.000/.306=3.268 in Health Sciences, 4.217/.306=13.781 in Exact and Earth Sciences, 1.190/.306= 3.888 in Engineering, and .649/.306=2.121 in Multidisciplinary Sciences, comparing to Human and Applied Social Sciences, taken together;
- the probability of journals having B3 or B4 or B5 is 1.804/.542=3.328 times lower in Agrarian Sciences, 1.804/.199=9.065 in Biological Sciences, 1.804/.346=5.214 in Health Sciences, 1.804/.164=11 in Exact and Earth Sciences, 1.804/.512=3.523 in Engineering, and 1.804/1.262=1.429 in Multidisciplinary Sciences, comparing to Human and Applied Social Sciences, taken together.

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Main Areas of Knowledge	Groups of the *Qualis* Scale							
	A1+A2		A1+A2 +B1		A1+A2+B1+B2		B3+B4+B5	
	Yes	No	Yes	No	Yes	No	Yes	No
Human and Social	69	1330	328	1071	499	900	900	499
(Yes/No ratio=odds)	.052		.306		.554		1.804	
Engineering	131	353	263	221	320	164	164	320
(Yes/No ratio=odds)	.371		1.190		1.951		.512	
Multidisciplinary	70	240	122	188	137	173	173	137
(Yes/No ratio=odds)	.292		.649		.792		1.262	
Exact and Earth	277	276	447	106	475	78	78	475
(Yes/No ratio=odds)	1.003		4.217		6.089		.164	
Health Sciences	147	471	309	309	459	159	159	459
(Yes/No ratio=odds)	.312		1.000		2.887		.346	
Biological Sciences	318	392	574	136	592	118	118	592
(Yes/No ratio=odds)	.811		4.220		5.017		.199	
Agrarian Sciences	59	322	236	145	247	134	134	247
(Yes/No ratio=odds)	.183		1.627		1.843		.542	

Table 3: Frequency and odds ratio of journals distribution in the Qualis system scale by field of knowledge from 2013 to 2016. **Source:** Elaborated by authors from original data available at *Sucupira Platform* (CAPES/MEC, 2017).

In a few words, chances for journals of the Humanities and of Applied Social Sciences being at the two or three highest levels of the Qualis system scale are much lower than for other main areas of knowledge, Biological, and Exact and Earth Sciences in particular. At the same time, chances for journals being at the lowest levels are much higher in the former main areas of sciences than in others.

Once again, findings support the hypothesis of a disproportionate distribution of journals in the Qualis system scale in the main areas of knowledge. Findings also support the hypothesis that, in some main areas of science, especially Biological, and Exact and Earth Sciences, journals are concentrated at the top of the Qualis system scale, while most journals of the Humanities and Applied Social Sciences are located at the bottom of the system, what goes against CAPES norms for journals distribution in the Qualis system scale.

Considering that beta coefficients of the logit multinomial regression (Table 4) shows whether the impact of the independent variables (fields of knowledge) on the dependent variable (Qualis levels) is positive or negative, journals that are out of Biological and Exact & Earth Sciences have a negative effect (-0.510 and -0.962, respectively) (Significance at < .10) on journals being at Qualis A1. It means that Biological and Exact & Earth Sciences have a positive effect on journals being at the highest level. Meanwhile, not belonging to Humanities or Applied Social Science is the most important factor (beta = 2.808) for journals being at the highest level. The same rationale follows for other levels of the Qualis scale. The overall results can be summarized in Graphic 2.

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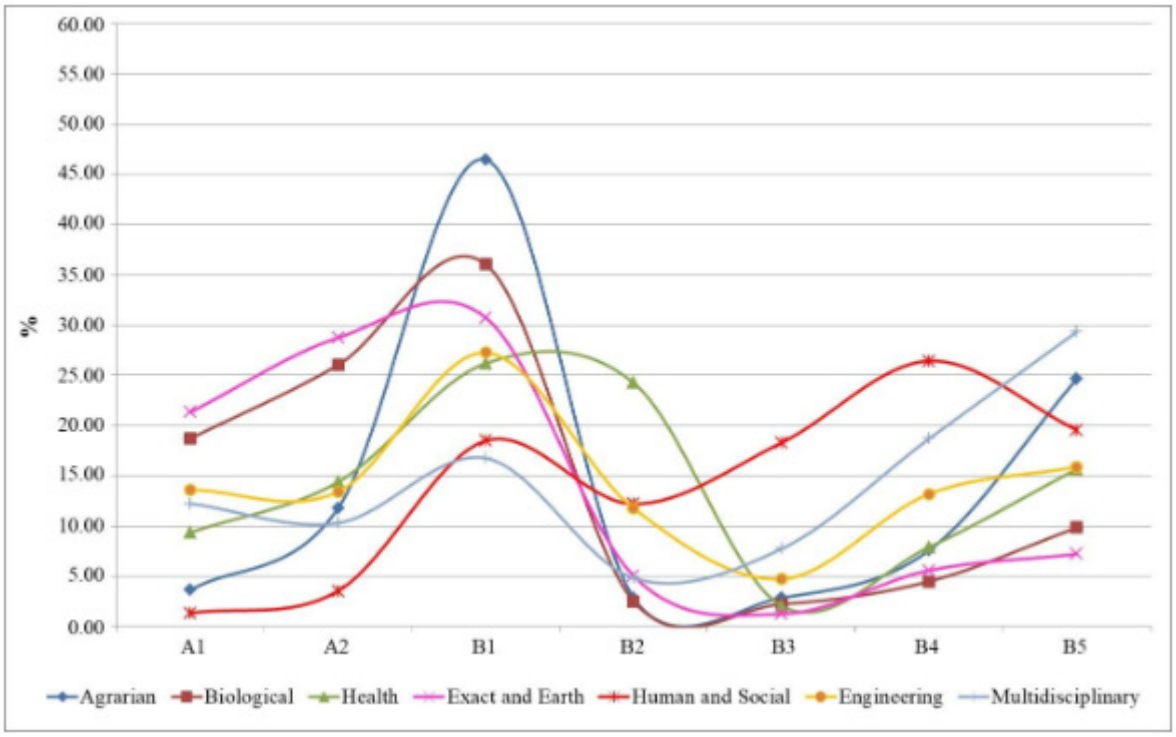

Graphic 2: Real distribution of journals in the scale of the Qualis system of main areas of knowledge of Environmental Sciences from 2013 to 2016. **Source:** Elaborated by authors from original data available at *Sucupira Platform* (CAPES/ MEC, 2017).

These last findings support the hypothesis that being in one or another main area of knowledge is an important factor to explain why journals are classified at the top or bottom of the Qualis system scale. A suggested hypothesis that Humanities and Applied Social Sciences have less research tradition to explain differences does not find ground on our data, once odds ratio, where coefficients come from, does not result from a relationship between two different areas of knowledge, but from inside each area, as shown in Table 3. In other words, other criteria than meritocratic factors explain, in great extent, journal classification at the Qualis system scale in Brazil.

Categorical variables[a]	B	Standard deviation	Wald	G.L.	Level of significance	e^b Exp(B)	Confidence interval for Exp(B): 95%	
A1[b] Intercept	-5,199	1,653	9,885	1	,002			
Agrarian=0	2,044	,392	27,190	1	,000	7,721	3,581	16,646
Biological=0	-,510	,300	2,878	1	,090	,601	,333	1,082
Health=0	,648	,312	4,305	1	,038	1,911	1,036	3,523
Exact and Earth=0	-,962	,316	9,292	1	,002	,382	,206	,709
Human and Social=0	2,808	,357	62,010	1	,000	16,585	8,244	33,364
Engineering=0	,300	,309	,947	1	,330	1,350	,737	2,473
Multidisciplinary=0	1,011	,323	9,785	1	,002	2,748	1,459	5,178

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A2 [b] Intercept	4,643	1,665	7,780	1	,005			
Agrarian=0	-,332	,334	,986	1	,321	,718	,373	1,381
Biological=0	-1,990	,305	42,660	1	,000	,137	,075	,248
Health=0	-,963	,311	9,562	1	,002	,382	,207	,703
Exact and Earth=0	-2,397	,319	56,577	1	,000	,091	,049	,170
Human and Social=0	,646	,317	4,153	1	,042	1,908	1,025	3,553
Engineering=0	-,778	,313	6,181	1	,013	,459	,249	,848
Multidisciplinary=0	,087	,333	,069	1	,793	1,091	,568	2,095
B1[b] Intercept	6,321	1,497	17,835	1	,000			
Agrarian=0	-1,100	,282	15,198	1	,000	,333	,192	,579
Biological=0	-1,723	,278	38,354	1	,000	,179	,104	,308
Health=0	-,968	,279	12,071	1	,001	,380	,220	,656
Exact and Earth=0	-1,861	,296	39,638	1	,000	,156	,087	,278
Human and Social=0	-,403	,264	2,323	1	,128	,668	,398	1,122
Engineering=0	-,922	,280	10,874	1	,001	,398	,230	,688
Multidisciplinary=0	,174	,294	,350	1	,554	1,190	,669	2,119
B2 [b] Intercept	1,148	2,048	,314	1	,575			
Agrarian=0	,929	,466	3,971	1	,046	2,531	1,015	6,308
Biological=0	,185	,417	,196	1	,658	1,203	,531	2,726
Health=0	-1,662	,362	21,047	1	,000	,190	,093	,386
Exact and Earth=0	-,844	,405	4,328	1	,037	,430	,194	,952
Human and Social=0	-,748	,354	4,464	1	,035	,473	,237	,947
Engineering=0	-,894	,371	5,808	1	,016	,409	,198	,846
Multidisciplinary=0	,662	,420	2,479	1	,115	1,938	,850	4,416
B3[b] Intercept	,508	2,414	,044	1	,833			
Agrarian=0	,374	,510	,539	1	,463	1,454	,535	3,952
Biological=0	-,276	,475	,339	1	,560	,758	,299	1,923
Health=0	,241	,492	,241	1	,624	1,273	,485	3,338
Exact and Earth=0	,019	,552	,001	1	,973	1,019	,346	3,005
Human and Social=0	-1,716	,412	17,371	1	,000	,180	,080	,403
Engineering=0	-,536	,450	1,422	1	,233	,585	,242	1,412
Multidisciplinary=0	-,402	,444	,820	1	,365	,669	,280	1,597
B4 [b] Intercept	1,569	1,815	,747	1	,387			
Agrarian=0	,359	,369	,949	1	,330	1,433	,695	2,952
Biological=0	-,017	,361	,002	1	,963	,983	,484	1,997
Health=0	-,131	,345	,145	1	,704	,877	,446	1,725
Exact and Earth=0	-,530	,371	2,041	1	,153	,589	,284	1,218
Human and Social=0	-1,122	,312	12,907	1	,000	,326	,177	,601
Engineering=0	-,614	,337	3,331	1	,068	,541	,280	1,046
Multidisciplinary=0	-,340	,334	1,036	1	,309	,712	,370	1,370

a. Parameters refer to independent variables coded 0 (not belonging to the area); all the time it is coded 1, parameters are set to 0 and deleted because of limited space.
b. Reference Category: B5.

Table 2: Coeficients B (logit and eb (B exponential of the natural log) for main areas of knowledge on levels of the Qualis system scale for the period of 2013 to 2016*. **Source:** Elaborated by authors from original data available at *Sucupira Platform* (CAPES/MEC, 2017).

CONCLUSION

Findings of this research suggest that classifying journals at the Qualis system scale and, thereafter, graduate programs and faculties evaluation, is a matter of policy and management regarding areas of knowledge, rather than real improvement of scientific investigation. Indeed, feelings that

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being at the top of the Qualis system scale is much harder for journals of Human Sciences or Applied Social Sciences than for others, especially Biological Sciences, Exact and Earth Sciences or Engineering, have here strong empirical support. It can be seen that CAPES research evaluation system, strongly structured on bibliometric tools, does not take into account the complexity of certain areas of knowledge, such as Environmental Sciences, and ignores the fact that papers and journals come from many areas of knowledge which have had different treatment in terms of journals distribution at the Qualis system levels. Human Sciences and Applied Social Sciences have been negatively discriminated against, compared to other main areas of science, as far as journals distribution in that system. Indeed, results signal that fields of science have become spaces of dispute of power and resources in the academic world.

It has been argued (BARATA, 2016) that the sharp disparities in the evaluation of journals of different areas of knowledge may be reduced with a proportional distribution of journals for each strata of the Qualis system, thereby democratizing management practices among science areas. However, such a democratization of science management may be achieved so long as proportionality be done for each area of knowledge within the Environmental Sciences field, thus considering the complexity and multidisciplinary within this area. We also suggest that, in order to reduce inequality and improve meritocratic criteria in qualifying research production among scientific fields, at least for Environmental Sciences, research evaluation should not be done as if this field contains only one area of knowledge.

Finally, one should be aware that discriminatory practices might not be exclusive to the Environmental Sciences field; similar mechanism may happen to all areas of the Multidisciplinary field of science, requiring, therefore, revewing the entire system of graduate programs evaluation from bibliometric tools, to improve policy on research evaluation in Brazil.

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