



SOCIAL SCIENCES

Impact of Open Access Policy on Brazilian Science and Global Trends

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Abstract: Open access (OA) publishing provides free online access to research articles without subscription fees. In Brazil, absence of financial support from academic institutions and limited government policies pose challenges to OA publication. Here, we used data from the Web of Science and Scopus to compare with global trends in journal accessibility and scientific quality metrics. Brazilian authors publish more OA articles, particularly in Global South journals. While OA correlates with quality for global authors, it had no impact on Brazilian science. To maximize impact, Brazilian authors should prioritize Q1 journals regardless of OA status. High-impact or Global North journal publication seems more relevant for Brazilian science than OA. Our findings indicate that the present open access policy has been ineffective to improve the impact of Brazilian science, providing insights to guide the formulation of scientific public policies.

Key words: Brazilian science, Journal impact factor (JIF), Category Normalized Citation Impact (NCI), Documents Cited (%DocCited), co-occurrence networks.

INTRODUCTION

Open access publishing refers to the practice of making scholarly research articles freely available online to anyone, without requiring them to pay for access or have a subscription to a particular journal or database (McCabe & Snyder 2014). Open access publishing aims to remove barriers to access scientific and scholarly research and increase the visibility and impact of research results. In open access publishing, the author(s) or their institution pays a fee to the publisher to cover the cost of publishing, formatting, and hosting the article online. Alternatively, some open access journals may be funded through grants or other sources, and do not charge authors a fee. Open access publishing can take many forms (Figure 1), including open access journals, hybrid journals that offer both open access and traditional

subscription-based access, and self-archiving in open repositories.

Open access publishing has been gaining traction in Brazil over the past decade. In addition to SciELO (Packer et al. 2014), there are several open access journals and repositories in Brazil that publish and make available scientific research articles (Orduña-Malea & Delgado López-Cózar, 2015, Robinson-Garcia et al. 2020). SciELO, initiated by the São Paulo Research Foundation (FAPESP) in Brazil in 1997, in collaboration with the National Council for Scientific and Technological Development (CNPq) and other institutions, stands out as a pivotal program. While it is not a direct government initiative, it has garnered support from various governmental bodies and has been instrumental in advancing open access publishing in Brazil and Latin America. Despite the significance

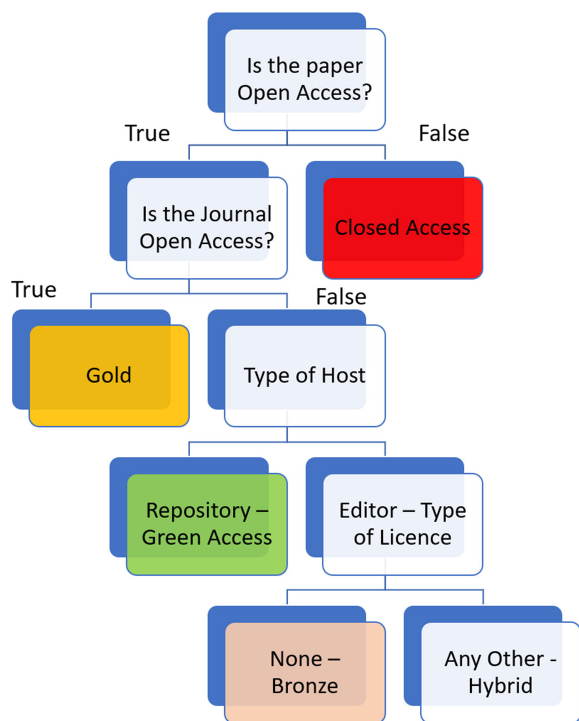


Figure 1. Types of Access.

of this initiative, it’s worth noting that Brazil currently lacks a comprehensive national open access policy (Kowaltowski & Oliveira 2019).

Although OA publishing can have positive effects, making science more expansive, collaborative, efficient, and transparent (Beck et al. 2020), the quality and heterogeneity of the component studies pose challenges for generalisations (Langham-Putrow et al. 2021). For example, some studies have found a positive correlation between the percentage of papers in OA and the number of citations, whereas others have been contradictory and inconclusive (McManus et al. 2023). Nevertheless, potential benefits for Brazil of increasing the visibility of the articles and the number of citations has led many authors to withdraw funds from already constrained research budgets to pay Article Publishing Charges (APCs).

The primary goal of scientific research is to generate new knowledge and insights that contribute to solving problems and

understanding the world. Different publishing parameters measure the scientific impact, translating the scientific community’s interest in each published article. Brazilian science renders significant contributions to global science, but insufficient funding in recent years has hindered its ability to publish in high-impact open-access journals, often due to a dearth of grants to pay APCs.

Plan S is an ambiguous plan to guarantee that all research funded by public grants is published in open-access (OA) journals by 2024 (Haug 2019), making scientific articles freely available without requiring pay for access (McCabe & Snyder 2014). For OA, authors themselves or their institution pays a publishing fee to cover the cost of publishing, formatting, and hosting the article online. Recently, the US government announced that all public institutions will be funded to publish their scientific articles in OA content. In Brazil, the payment of APCs for OA publications is complex (Pavan & Barbosa 2018, Appel & Albagi 2019) and challenging for any researcher. Typically, Brazilian academic institutions do not pay to publish articles in OA journals, and few governmental policies help cover these costs.

In Brazil, the payment of APCs for open access publications varies depending on the journal and the funding source. Some Brazilian journals that offer open access options do not charge APCs, while others may charge a fee that is typically paid by the authors or their institutions. Some Brazilian universities have established funds to support open access publishing by their faculty and researchers. Overall, the payment of APCs for open access publications in Brazil is a complex issue, and the funding sources and mechanisms can vary widely depending on the specific journal and the researcher’s affiliations and funding sources (Pavan & Barbosa 2018, Appel & Albagi 2019).

The average APC cost for open access journals in Brazil was around USD 250, which is significantly lower than the global average of around USD 840 (McManus et al. 2020b). However, it is worth noting that the APC costs can vary widely depending on the journal and the publisher, and some journals may charge significantly higher or lower fees. In this paper, we compared Brazilian with world publishing in terms of open access and publishing location.

MATERIALS AND METHODS

We evaluated publishing sources (journals) for Brazilian authors between 2013 and 2022 and compared them with the rest of the world. Data was downloaded from Incites®, based on Web of Science from Clarivate Analytics. The publishing location was classified as i) Global South or Global North and as ii) open or closed access. Journals that publish any types of gold or green articles were classified as OA. Hybrid journals with less than 60% open access were classified as closed and were delimited to journals with at least 100 papers. Data were analysed using SAS v.9.4 (Statistical Analysis System Institute, Cary, North Carolina). Procedures included i) PROC GLM (Analysis of Variance) to compare publishing access and location types; ii) PROC LOGISTIC (Logistic Regression) to see the effects of publishing country and journal quartile and global region on the decision to publish open access by Brazilian authors; iii) PROC PRINCOMP

(Principal Components) to see relationships between quality and quantity indicators; iv) PROC HPSPLIT (Decision tree) to see what decisions affect citation impact and v) PROC CALIS (Path ANALYSIS) to see paths to high impact publishing for Brazilian authors, including access choices.

We also evaluated Brazilian studies on OA publishing from Scopus (Figure 2). Co-authorship, Co-occurrence of keywords, Citation, Bibliographic coupling, and Co-citation keywords were mapped in VosViewer (Visualisation of similarities) according to van Eck & Waltman (2010, 2017) and Waltman & Van Eck (2012, 2013).

The data viewed are as follows:

Co-authors –analysis of the number of co-authors from the papers, their country and affiliations, with links between them.

Keyword Co-occurrence networks - author keywords listed in the same paper. Each keyword is a node and each co-occurrence of a pair of words is a link (Radhakrishnan et al. 2017).

Citations – is a link between two items, where one item cites the other.

Bibliographic Coupling - similarity between two documents based on the number of references they have in common.

Co-citation –studies that have cited a particular pair of documents and helps to explain the similarity and dissimilarity among them, authors, and journals (Köseoglu et al. 2015). Helps to identify the strength of relationships between articles and highlight clustering within the network (Wong et al. 2021).

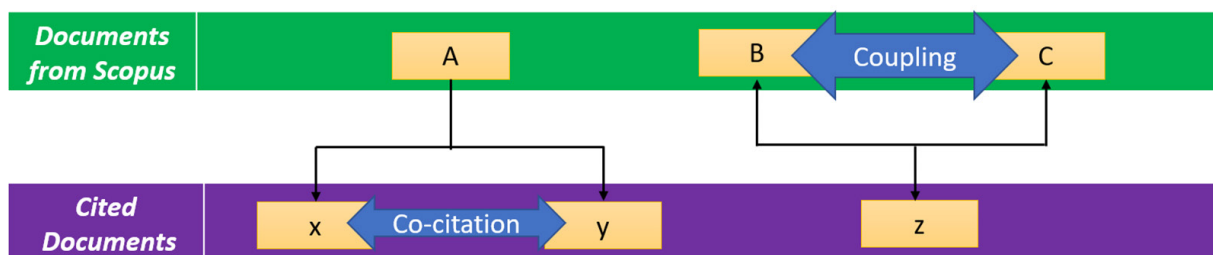


Figure 2. Diagram of Citation Analyses in this paper.

Each paper is fractioned according to the number of co-authors (Cancino et al. 2017, Gaviria-Marín et al. 2018, Martínez-López et al. 2020). The number of documents co-authored and the number of authors of each co-authored document determines strength of a co-authorship link between two authors (McManus et al. 2023). The units of analyses in the above analyses can be countries, (co)authors, documents, references, and publishing sources.

Co-citation measures the extent to which two or more documents are frequently cited together in other scientific articles. This is useful for identifying influential articles and researchers in a given field. It can also identify information sources and inspiration for future research. Bibliographic coupling, on the other hand, measures the similarity between two documents based on the number of references they have in common.

Vosviewer produced linkage maps based on the data above and assigned authors, papers, keywords, countries and citing sources to clusters, which are visually depicted, with different colours. Clusters were formed using association strength/proximity or probabilistic affinity index. Timelines were also constructed in Vosviewer to show mean years for publications of the same variables. These help in understanding the journal's progress over time and its future trends (Ding & Yang 2022). In the VosViewer figures, a larger circle indicates a higher occurrence of a keyword, countries, author etc in the authors, title and abstract according to Scopus. If the colour of the connecting between words is more vibrant, then the word/researcher/country is more commonly found in different documents. With small connections, the colour is more transparent. Cluster information was downloaded at each stage for further analyses.

RESULTS AND DISCUSSION

To guide national policies, it is fundamental to identify the impact of OA practice on both the quality and visibility of articles from authors of different World regions, including Brazil. Data from the Web of Science (between 2013 and 2022) show that Brazilians are more likely to publish OA articles ($\approx 52\%$, being 24% in the North OA and 28% in the South OA. See Fig. 3a) than authors around the world ($\approx 28\%$, being 23% in the North OA and 4% in the South OA. See Fig. 3b).

Authors from Brazil publish more articles in journals of the Global South (31% , being 28% open and 3% closed access) compared with authors worldwide (7% , being 4% open and 3% closed access) (Fig. 3a-b), with a higher percentage of them published in OA journals (88%) (Fig. 3c, left panel). In journals of the Global North, there is no difference in the percentage of OA articles published by Brazilian or world authors (Fig. 3c and 3d, right panels, respectively). Likewise, Brazilian authors have higher odds (Table I) of publishing OA (2.35) but lower odds of publishing OA in the North compared with the South (0.23). These data suggest that Brazilian authors have published more articles in the global North, but concentrate OA publishing in the Global South.

Journal Impact Factor (JIF), Category Normalized Citation Impact (CNCI), and % Documents Cited (%DocCited), are commonly used to evaluate the impact and visibility of scientific journals. In a previous study, some of us found a tendency for Brazilian authors to publish closed access in prestigious publishers (McManus et al. 2020b). Brazilian and World authors perform better (JIF, CNCI and %DocCited) when publishing in Global North journals (Fig. 3e-j). OA publishing has a small tendency to improve JIF (Fig. 3e-f), except for articles published by Brazilians in the global

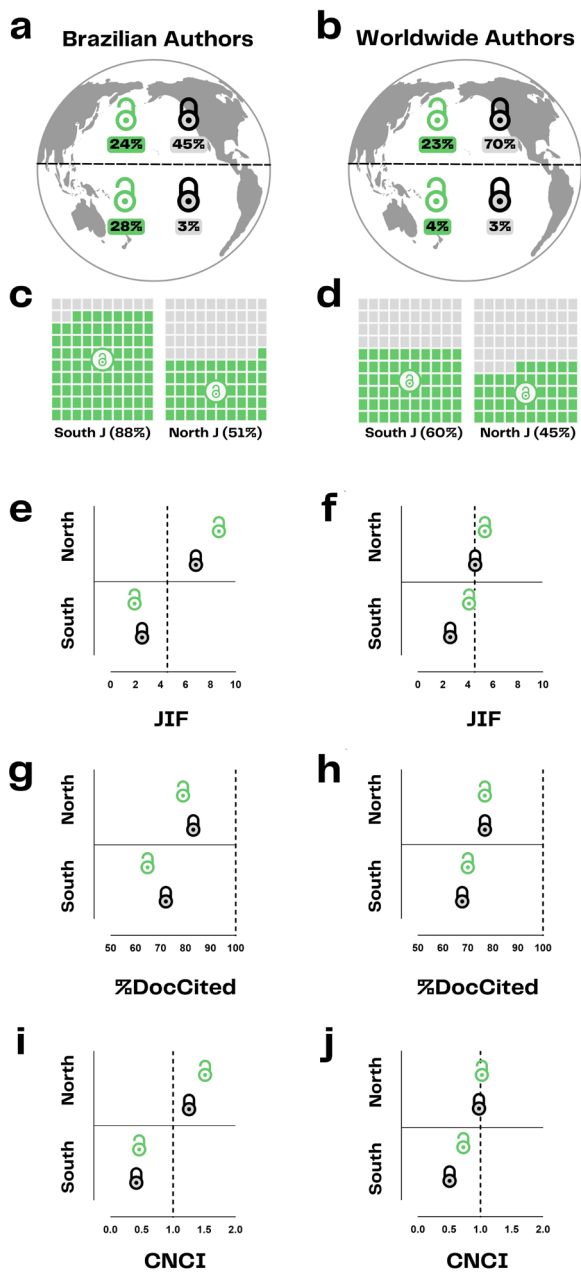


Figure 3. Brazilian authors publish more OA articles than authors around the world, especially in journals of Global South. Publishing sources, between 2013 and 2022, were accessed from Incites®, based on Web of Science from Clarivate Analytics. a-b) Open and closed access publishing in the Global North and South published by Brazilian (a) or worldwide (b) authors. c-d) Percentage of open access journals published by Brazilian (c) or worldwide (d) authors in the Global South or North. e-f) Average of Journal Impact Factor (JIF) of open or closed access articles published by Brazilian (e) or worldwide (f) authors in Global North and South journals (dotted line represents what is expected from a suitable JIF). g-h) Percentage of documents cited (%DocCited) published by Brazilian (g) or worldwide (h) authors in open or closed journals from Global North and South. i-j) Average of Category Normalised Citation Index (CNCI) of open or closed access articles published by Brazilian (i) or worldwide (j) authors in journals from Global North and South (dotted line represents what is expected from a suitable CNCI). N= 7909 journals, when 281 from Brazilian and 7628 from worldwide authors. 🟢 = open; 🔒 = closed; South J = Global South Journals; North J = Global North Journals.

South (Fig. 3e). These data demonstrated that when Brazilian authors publish in the Global South, they publish predominantly OA, with an impact of approximately 1/3 of that if they had published open or closed access in the Global North (Fig. 3e). Conversely, World authors publish with improved JIF values in OA independent whether it is in the Global North or Global South (Fig. 3f).

The influence of OA on citation remains uncertain, particularly when considering the range of disciplines, data sources, publishing models, and author regions (Langham-Putrow et al. 2021). To Brazilian authors, the OA format did not improve the %DocCited, both when published in the South and North journals (Fig. 3g). Closed Access articles published by Brazilians present a higher %DocCited than OA when published by Brazilians in the Global South and this trend is also true considering Global North publications (Fig. 3g). For world authors, this tendency is not observed both in the Global North and South publications, as seen in Fig. 3h. In addition, we found a positive effect of OA policy in the CNCI of Brazilian articles when it is published in the Global North (Fig. 3i). For authors around the world, OA increases the CNCI articles of Global South journals (Fig. 3j), with no effect on articles published in the Global North. Strengthening these results, analysis of variance demonstrates that JIF as well as accessibility are important in

influencing the % of document citations (Data not shown).

The analysis of variance (tables II and III), show that the Journal Impact Factor was an important criteria for all variables.

Brazilian authors publishing closed access in journals from the Global North showed little difference in impact and citation rates than closed access in the Global North (Supplementary Material - Table SI), but significantly higher than if they published Open Access in Southern journals. When Brazilian authors publish in the Global South they publish predominantly OA, but with an impact of approximately 1/3 of that if they had published open or closed access in the Global North. They are also a lower % of corresponding authors in Global North journals, and a higher percentage of international collaborations (53% in Open Access vs 35% closed access). This is higher than when compared to publishing in Southern journals.

Several independent variables can directly affect the impact of science (McManus & Baeta Neves 2022). Here, we used Path Analysis to identify relationships between science quality variables (%DocCited, Citation Impact, CNCI, Highly Cited, Article Influence, Immediacy Index and 5-year JIF) and OA policy. While publishing OA positively correlates many quality parameters of articles published by worldwide authors

Table I. Odds ratios for publishing Open Access¹.

Publishing Country	Brazil		
World	2.35***		
Quartile	Q1	Q2	Q3
Q2	1.07ns		
Q3	1.36***	1.28**	
Q4	1.34***	1.25**	0.98ns
Global Region	North		
South	0.23***		

*P<0.05; ** P<0.01, ***P<0.001, ns – not significant.

¹ The interpretation of this Table is as follows: The value of 2.35 means that Brazilian authors have a higher odds (2.35 times) of publishing open access than authors outside Brazil; Global North authors have a lower probability of publishing OA than Global South (0.23x).

(Fig. 4b), article type choice has no impact on Brazilian science (Fig. 4a). We used decision tree analysis to identify which decisions could affect the citation impact of Brazilian science. In the decision tree for high-impact publishing, Brazilians should seek to publish in Q1 journals independent of whether they are OA or not (Fig. 4c). While it is also essential to worldwide authors, international collaborations and OA article type is significant for published high impact articles (Fig. 4d). Together, these data

Table II. Summary of Analysis of Variance for Open Access Publishing.

	%Gold	%Green	%No OA	%Hybrid	%Dom	%Inter	JNCI
JIF	***	***	***	***	***	***	***
Region	***			*	***	***	*
Brazil/World	***	***		***	*	***	***
BW*Region					***	***	
OA	***	***	***	*	Ns	***	***
OA*Region			***	*	***	***	
BW*OA	*	***	***		*	***	***
BW*OA*Region	ns				***	***	

suggest that publishing in high-impact or Global North journals has more relevance to improving the Brazilian science impact than publishing OA.

Looking towards a higher CNCI, the path analysis (Table IV) shows that the journals where Brazilians publish OA have a lower % of documents cited and a lower % of international collaborations. A higher percentage of the latter leads to higher % of documents cited. Worldwide Open Access improves impact such as immediacy index, five-year impact, article influence and highly cited papers, but not for Brazilians.

Looking at the research areas as defined by CAPES (Table V), we see that the social sciences and humanities (SSH) publish fewer papers and have less papers cited than the other areas. SSH also have a lower percentage of international collaborations. Closed Access and published in Brazil has the worst impact compared to the other options. Brazilian journals have fewer Q1 and Brazil has a lower % of corresponding authors when publishing in international journals. Once again, publishing closed access abroad has higher CNCI than open access in Brazil. The SSH also publish more in closed and

open access in Brazil than the other areas (Table VI), while exact publish more in closed access in international journals.

Looking at impact, publishing internationally, independent of whether open or closed showed higher impact than publishing in Brazil (Figure 5). Open access in Brazil tended to show higher impact than closed access. World open access showed higher % papers in top 10% cited for no poverty, while Quality Education tended not to show a difference between publishing open access in Brazil, or publishing internationally for % of documents cited. CNCI for quality education in open access in Brazil did not differ from closed access internationally. For higher impact the order was open access internationally, closed access internationally, open access in Brazil and then closed access in Brazil.

Similar patterns are seen when looking at the SDGs (Table SII). Brazilians as corresponding author publishing more in closed access than open access in international journals (Figure 6), while there is no difference when they publish in Brazil. This may be because of the ability to pay APCs. Papers published abroad have a higher % of international collaboration, independent

Table III. Summary of Analysis of Variance for Impact of Publishing.

	%DocsCited	%Corresp	%Hot	Average Jif	Cited Half Life	Article Influence Five Year Immediacy JCI, %High Patents, CI	JCI Percentile
JIF	***	***	***		***	***	***
Region	***	***					***
Brazil/World	Ns	****		*			
BW*Region	Ns	*	*		***		
OA	*	***			***		
OA*Region	Ns	***			***		*
BW*OA	*	Ns		***			
BW*OA*Region	ns	***		*			

*P<0.05; ** P<0.01, ***P<0.001, ns – not significant. BW – Brazil vs World; OA – Open Access; JIF – Journal Impact Factor; CI- Citation Impact; JCI – Jorna Citation Index.

of SDG. The two SDGs with higher industry collaboration are Decent Work and Reduced inequality, both with higher % published abroad. In terms of JNCI, there is little difference between SDGs but Brazil closed Access tends to have a higher JNCI and World Closed, lower.

Publishing Networks

For the analysis of the publications in Scopus, 321 documents were found from Brazilian authors on the subject of Open Access and related subjects. There was an increase in papers on this topic up to 2018 (Figure 7) but then there was a strong decrease after this. Most papers are Brazilian, with little international interaction.

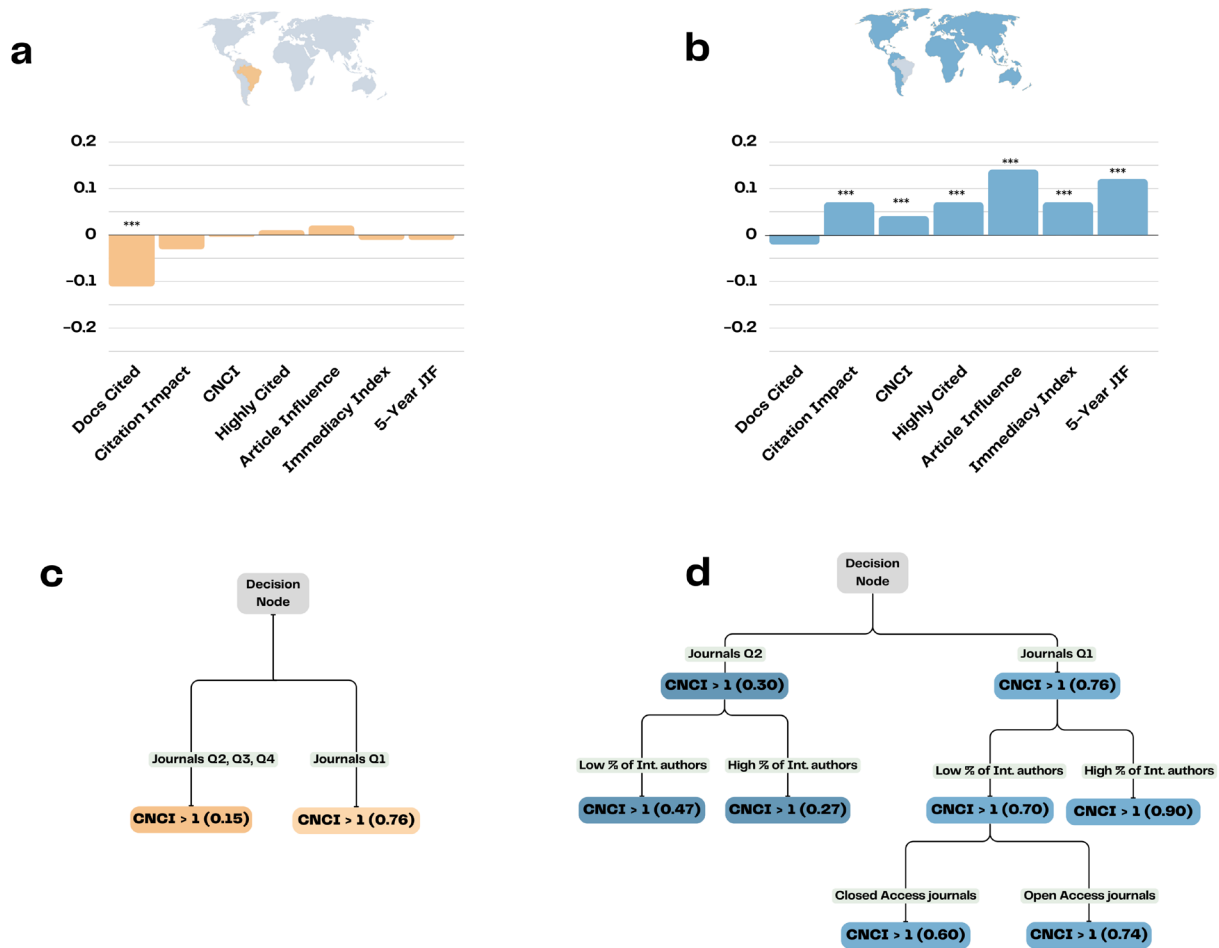


Figure 4. Open Access has no impact on scientific quality metrics of Brazilian authors' publications. a-b) Path analysis to evaluate the relationships between Open Access articles and scientific quality metrics of articles published by Brazilian (a) and Worldwide (b) authors. c-d) Decision tree to evaluate the choices that result in more chance to attain publication with CNCI >1 for Brazilian (c) and worldwide (d) authors publications. %DocCited = percentage of documents cited; CNCI = Category Normalized Citation Impact (CNCI), 5-year JIF = 5-year Journal Impact Factor; Q1, Q2, Q3 and Q4 = quartiles that categorize journals by impact factor, with Q1 as the highest and Q4 as the lowest; Low % of Int. authors = percentage of international authors in the articles lower than 37%; High % of Int. authors = percentage of international authors in the articles equal or higher than 37%; Closed Access Journals = Journals with less than 28% of open access papers; Open Access Journals = Journals with more than 28% of open access papers. N = 281 journals with Brazilian authors publications; N = 7628 journals with worldwide authors publications. ***P<0.001.

Major funding comes from Capes and CNPq, as well as FAPESP (Table VII). BMBF and UNESCO are international funders in the top ten, although with a limited number of papers.

Major institutions studying this theme are public (Table VIII), especially federal.

The major international networks (Figure 9) show that Brazilian networks dominate this

Table IV. Path Analysis for Brazilian (A) and rest of the world (B) authors.

Path			Brazil	Pr > t	World	Pr > t
%OA	====>	%DocsCited	-0.33	<.0001	-0.02	0.01
%Corresp.	====>	%DocsCited	0.46	<.0001	0.15	<.0001
%Corresp.	====>	%Domestic	0.81	<.0001	0.07	<.0001
%Corresp.	====>	%International	-0.86	<.0001	-0.74	<.0001
%Domestic	====>	%DocsCited	0.11	0.14	0.23	<.0001
%International	====>	%DocsCited	1.01	<.0001	0.66	<.0001
%Domestic	====>	%Hybrid	0.13	0.10	-0.14	<.0001
%International	====>	%Hybrid	0.28	0.00	0.17	<.0001
%Domestic	====>	%OA	0.07	0.39	0.15	<.0001
%International	====>	%OA	0.13	0.12	0.24	<.0001
%OA	====>	%DocsCited	-0.11	<.0001	-0.02	0.01
%OA	====>	CitationImpact	-0.03	0.60	0.07	<.0001
%OA	====>	CitedHalfLife	-0.21	0.00	-0.18	<.0001
%OA	====>	ArticleInfluence	0.02	0.71	0.14	<.0001
%OA	====>	ImmediacyIndex	-0.01	0.82	0.07	<.0001
%OA	====>	FiveYear	-0.01	0.86	0.12	<.0001
%OA	====>	%HighlyCited	0.01	0.83	0.07	<.0001
%DocsCited	====>	%HighlyCited	0.06	0.01	0.27	<.0001
%Domestic	====>	CitationImpact	-0.53	0.01	0.01	0.33
%International	====>	CitationImpact	0.18	0.17	0.24	<.0001
%Domestic	====>	CitedHalfLife	0.07	0.01	-0.07	<.0001
%International	====>	CitedHalfLife	-0.01	0.59	-0.01	0.42
%Domestic	====>	ArticleInfluence	-0.09	0.01	-0.02	0.17
%International	====>	ArticleInfluence	0.03	0.28	0.26	<.0001
%Domestic	====>	ImmediacyIndex	-0.12	0.01	-0.01	0.59
%International	====>	ImmediacyIndex	0.02	0.61	0.19	<.0001
CitedHalfLife	====>	CitationImpact	1.19	0.01	-0.05	<.0001
CitationImpact	====>	CNCI	0.74	<.0001	0.65	<.0001
CitedHalfLife	====>	CNCI	0.03	0.01	-0.01	0.01
ArticleInfluence	====>	CNCI	-0.29	<.0001	0.42	<.0001
ImmediacyIndex	====>	CNCI	-0.07	<.0001	0.14	<.0001
FiveYear	====>	CNCI	0.56	<.0001	-0.28	<.0001
%HighlyCited	====>	CNCI	0.13	<.0001	0.20	<.0001

theme, with little international interaction. Keyword clusters (colours in Figure 10), show groups of study on open data and science (orange), bibliometrics (green), altmetrics (red) and digital repositories (blue). The question of open science and data are more recent while repositories are older. Major papers (Figure 11) are those of Chan et al. (2005), Meneghini et al. (2006), Bezerra (2016), and Perlin (2018). The journals that most publish on the subject (Figure 12 and Table IX) are Brazilian (*Ciência da Informação*, *Transinformação*, *Perspectivas em Ciência da Informação*, among others). The main international journal is *Scientometrics* (Table IX).

DISCUSSION

The importance of impact in scientific writing can be understood in several ways. The primary goal of scientific research is to generate new knowledge and insights that contribute to our understanding of the world. Higher impact (as classified in bibliometric databases) in research means that the science produced has generated interest within the community. McManus et al. (2020b) also found a tendency for Brazilian authors to publish closed access in prestigious publishers. These authors suggest more dissemination of green open access publishing, to decrease total publication costs, increase

Table V. Percentages of papers and type of Publication depending on area of knowledge.

	Brazil		World	
	Open	Closed	Open	Closed
Percentage of Papers				
Exact Sciences	5,46	2,82	33,48	58,24
SSH	22,58	12,48	32,61	32,33
Life Sciences	16,93	1,98	41,68	39,41
Category Normalised Citation Index				
Exact Sciences	0,30	0,17	1,12	0,72
SSH	0,38	0,09	1,57	0,70
Life Sciences	0,33	0,19	1,49	0,82

SSH – Social Sciences and Humanities; Open/Closed – types of access.

Table VI. Publishing indicators depending on the Capes area, type of access and where the papers were published.

		Documents	% Docs Cited	CNCI	JNCI	% International	% Corresp	Q1	% Top 10%
Open Access									
Brazil	Exact	23693	64.18	0.25	0.95	11.39	97.64	4.03	0.53
	SSH	48642	30.12	0.26	0.84	5.96	97.78	3.18	1.07
	Life	105258	74.57	0.34	0.98	10.18	97.99	1.02	1.08
World	Exact	145234	78.97	0.95	1.02	49.21	73.76	43.71	8.01
	SSH	70244	35.88	0.59	0.86	15.48	90.94	29.43	3.96
	Life	259124	79.82	0.95	1.04	33.18	81.94	31.00	7.32
Closed Access									
Brazil	Exact	12249	40.47	0.11	0.72	9.07	97.00	3.15	0.11
	SSH	26876	15.78	0.07	0.69	4.30	97.18	0.24	0.23
	Life	12310	56.43	0.17	0.90	6.99	97.67	0.20	0.33
World	Exact	252674	70.99	0.71	0.77	31.22	84.91	47.20	5.51
	SSH	69637	32.98	0.49	0.69	17.48	87.43	31.35	3.77
	Life	245063	69.49	0.81	0.89	32.32	72.77	41.57	5.67

equality of opportunity to publish, and increase the integrity in science reporting (James 2017).

The question of publishing in a local journal differs between areas of knowledge. Overall, the decision to publish in local scientific journals versus English-language journals is likely influenced by a combination of factors, including audience, language barriers, relevance, and

funding priorities (McManus & Baeta Neves 2021).

Social scientists may choose to publish more in local scientific journals instead of in international journals and in English. These scientists may be primarily interested in communicating their research findings to a local or regional audience, rather than an international audience (Sivertsen 2016). Publishing in local

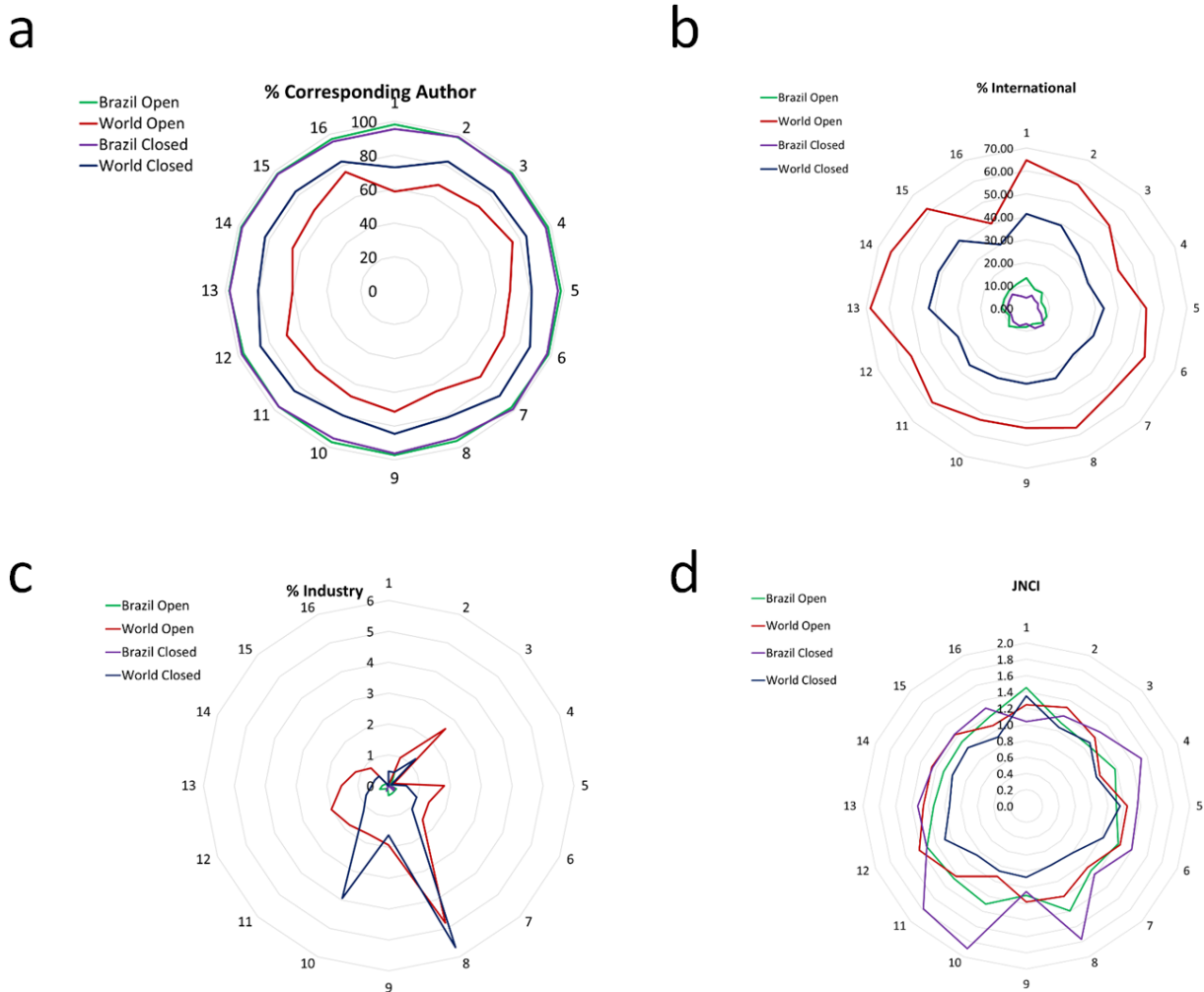


Figure 5. Influence of Sustainable Development Goals (SDGs) on Scholarly Impact by Publication Origin and Access. This figure presents the variation in impact across Sustainable Development Goals (1-16) based on the publication's origin (Brazil or World) and access type (open or closed). (a) shows the percentage of publications where the corresponding author is from Brazil or the World. (b) represents the proportion of international collaborations. (c) details the percentage of industry-linked publications. (d) illustrates the Journal Normalised Citation Index (JNCI), indicating citation impact. The SDGs are numbered 1 to 16, corresponding to their official United Nations enumeration.

scientific journals may be a more effective way to reach their intended audience and have a greater impact on the local research community (Mugnaini et al. 2014). Social scientists who are not native English speakers may face challenges in writing and publishing in English-language journals. Writing in their native language may be easier and more comfortable, and local journals may be more accommodating of non-native English speakers. The dominance of English as a scientific language poses challenges for non-native speakers, and efforts are needed to address these challenges and promote greater inclusivity and diversity in scientific

communication. McManus & Baeta Neves showed that Brazilian SSH scholars publish less papers in English than other areas of knowledge. English as a scientific language may perpetuate biases in favor of native English speakers, as they may have an advantage in terms of access to publications, funding, and networking opportunities. Non-native speakers may struggle with the complexity of English scientific language, which often involves technical terms and specific jargon that may not be familiar to them. This can make it difficult to understand and communicate scientific concepts accurately and precisely. This also works in the opposite

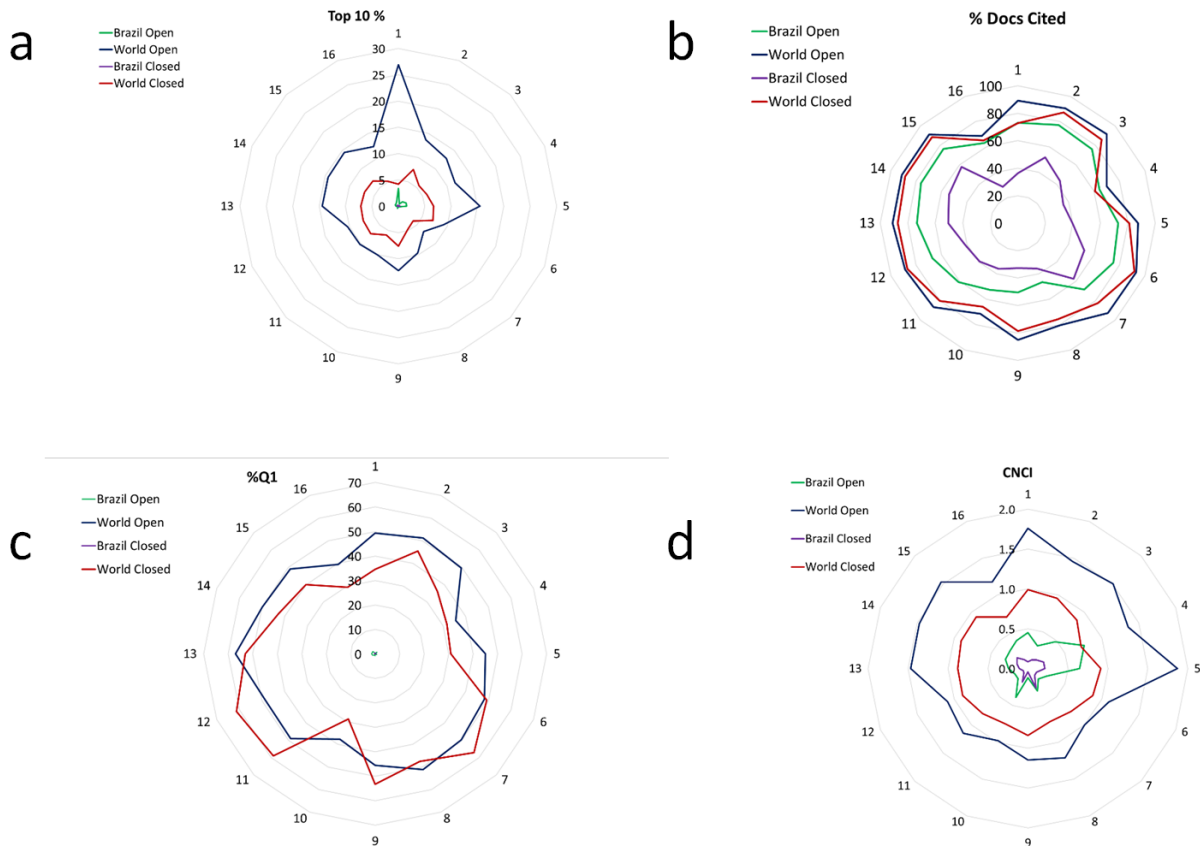


Figure 6. Impact Variation on Sustainable Development Goals (SDGs) by Publication Origin (Brazil or World) and Access Type (Open or Closed). (a) displays the percentage of documents within the Top 10% of citations, indicating highly cited research. (b) illustrates the percentage of documents that have been cited, reflecting overall research visibility. (c) shows the percentage of papers published in top quartile (Q1) journals, signifying publication in high-quality venues. (d) presents the Category Normalised Citation Index (CNCI), which measures citation impact relative to the subject field. The SDGs are numbered 1 to 16, corresponding to their official United Nations enumeration.

manner, as English speakers may face difficulties in understanding the cultural nuances of local scientific communication, which can affect their ability to interact effectively with colleagues and understand expectations of the scientific community. Van Leeuwen et al. (2001) pointed to language bias leading to under-rating non-English domestic journals.

Research topics in social sciences may be more relevant to local or regional issues, and publishing in local journals may allow for greater engagement with local policymakers and practitioners (Olmos-Peñuela et al. 2014), as governments use this knowledge to promote and legitimize their policies (Larivière et al. 2018). Publishing in international journals may be less relevant or have less impact on local

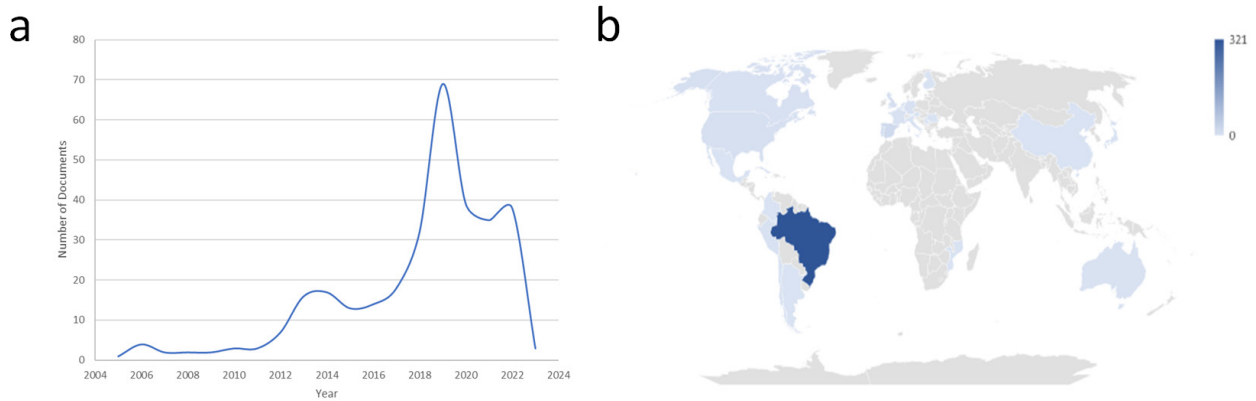


Figure 7. Trends in Open Access Publishing Related to Brazil. (a) Depicts the annual number of research papers published by Brazilians about open access and related subjects from 2004 to 2023, showing fluctuations in research output over time. (b) Illustrates the distribution of open access publications by country, with a concentration on Brazil, and shades indicating the volume of research, ranging from light to dark as the quantity increases.

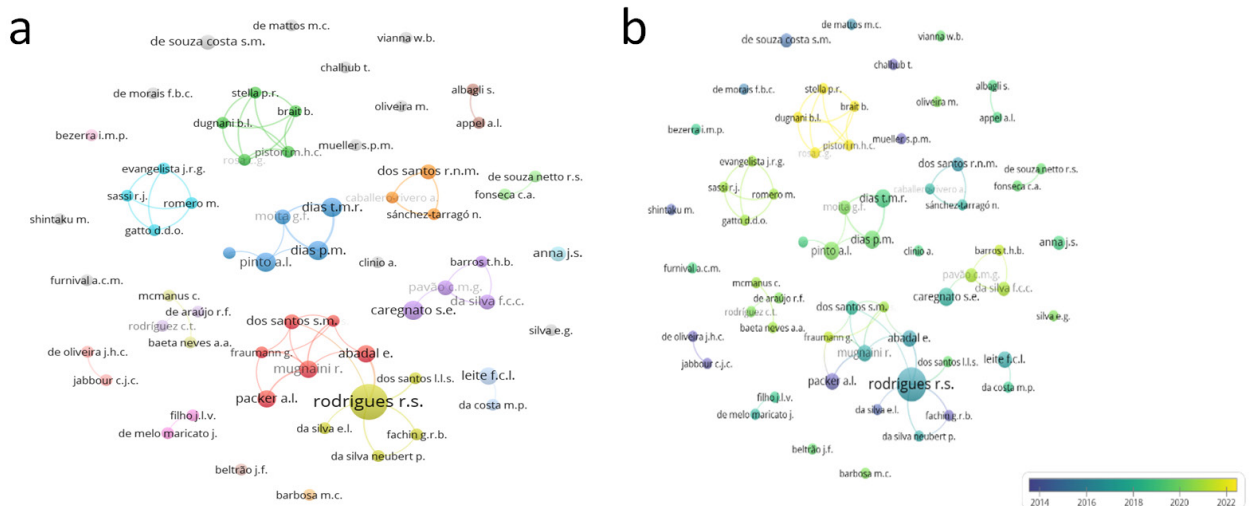


Figure 8. Collaborative Clusters and Temporal Trends in Open Access Publishing in Brazil. Panel (a) maps the main clusters of Brazilian authors collaborating on open access publications. Panel (b) displays the average year of publication for these clusters, with the color gradient ranging from earlier (cool tones) to more recent (warm tones) years of publication.

issues. Some funding agencies or institutions may prioritize local research and encourage or require researchers to publish in local journals. This may be seen as a way to promote research that is relevant to local needs and priorities.

McManus & Baeta Neves (2021) also showed that SSH produce less scientific papers per lecturer than other areas of knowledge, preferring other production types such as

presentations, books, chapters, congresses, short courses, etc.

Dewan & Shah (2016), showed that indexing in international databases may be a challenge for regional and national journals, especially those published in native languages. It is also important to remember that not all research shows global relevance, although it may be regionally important (Mathies et al. 2020).

Table VII. Main funders of papers on open access in Brazil.

Funding sponsor	Documents
Conselho Nacional de Desenvolvimento Científico e Tecnológico	23
Coordenação de Aperfeiçoamento de Pessoal de Nível Superior	21
Fundação de Amparo à Pesquisa do Estado de São Paulo	12
Bundesministerium für Bildung und Forschung	2
Empresa Brasileira de Pesquisa Agropecuária	2
Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro	2
Fundação de Ensino e Pesquisa de Uberaba	2
Instituto Nacional de Ciência e Tecnologia de Informação Quântica	2
Ministério da Ciência, Tecnologia e Inovação	2
United Nations Educational, Scientific and Cultural Organization	2

The network (Figure 8) for authors (Table VIII) in this area shows a lack of connections between the different groups in Brazil studying this theme.

Table VIII. Major authors and institutions publishing on open access in Brazil.

Author	Docs	Affiliation	Docs
Rodrigues, R.S.	17	Universidade Federal de Santa Catarina	46
Caregnato, S.E.	5	Universidade de Brasília	30
Dias, P.M.	5	Universidade de São Paulo	27
Dias, T.M.R.	5	Universidade Federal de Minas Gerais	22
Packer, A.L.	5	Universidade Federal do Rio Grande do Sul	21
Pinto, A.L.	5	Universidade Federal do Rio de Janeiro	16
Abadał, E.	4	Universidade Estadual Paulista Júlio de Mesquita Filho	13
Leite, F.C.L.	4	Fundação Oswaldo Cruz	12
Mugnaini, R.	4	Instituto Brasileiro de Informação em Ciência e Tecnologia	11
Anna, J.S.	3	Universidade Federal de São Carlos	10
Moita, G.F.	3	Universidade Federal Fluminense	9
		Universidade Federal de Alagoas	9
		Universidade Federal do Parana	9

While SciELO and Redalyc have made significant contributions to the open access movement and the dissemination of scientific research in these regions, there have also been some criticisms and challenges associated with the platform (Strehl et al. 2016). These bases mainly focus on scientific journals from Latin America, the Caribbean, Spain, Portugal, and South Africa, which may limit its scope and reach compared to other international databases. While SciELO has established a peer-review

process for its journals, some researchers have criticised the quality of the articles published on the platform, suggesting that the standards for acceptance may not be as high as those for other international databases (McManus & Baeta Neves 2022). Many articles on SciELO and Redalyc are published in Spanish and Portuguese, which may limit their accessibility to non-Spanish and Portuguese-speaking researchers. Substantial overlaps in publications were also found by McManus & Baeta Neves (2022) when comparing

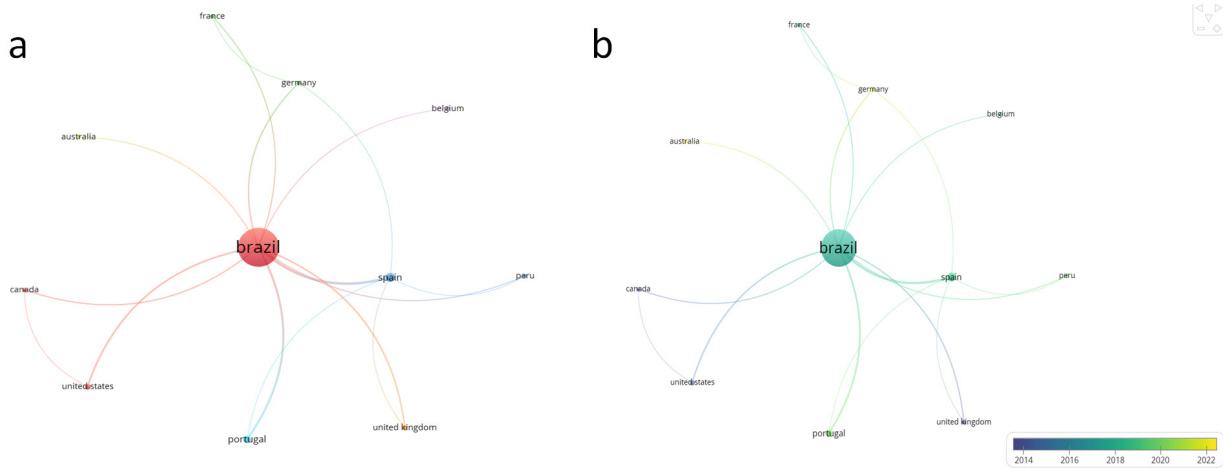


Figure 9. Visualization of Global Collaborative Networks in Brazilian Publications about Open Access. Panel (a) illustrates the interconnections between Brazil and other countries based on author collaborations. Panel (b) shows the mean publication year of articles within these networks, with the color gradient indicating more recent (yellow) to earlier (blue) collaborations.

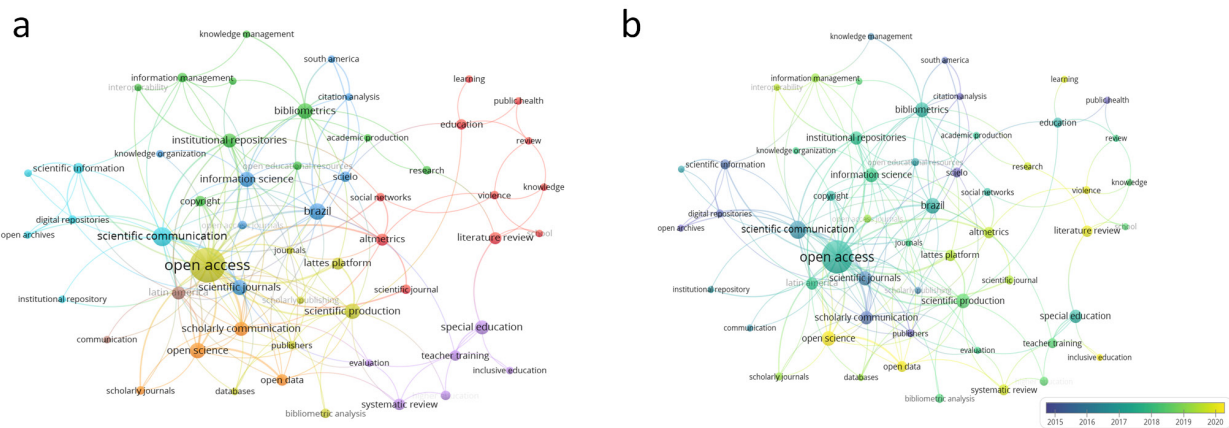


Figure 10. Conceptual Mapping and Temporal Analysis of Keywords in Brazilian Publications about Open Access. (a) illustrates thematic clusters of keywords associated with Open Access research in Brazil. (b) shows the average publication date of articles associated with each keyword, with colors transitioning from blue for older to yellow for more recent articles.

Brazilian publication in WoS, Scopus, Redalyc and SciELO. While the platforms have made significant strides in promoting open access to scientific research in Latin America and other regions, some researchers have raised concerns about the visibility of articles published on the platform, suggesting that they may be less visible and less frequently cited than articles published on other international databases. Some researchers have raised concerns about the long-term sustainability of these bases, as they rely on the support of funding agencies and governments in the regions where it operates, which may be subject to political and economic instability. While these bases have made important contributions to the dissemination of scientific research in Latin America and other regions, there are also several challenges and criticisms associated with the platform that need to be addressed to ensure its long-term viability and impact.

Scientific networking refers to the process of building relationships and collaborating with other scientists and researchers in one's field of study (Fortunato et al. 2018). It can lead to opportunities for collaboration on research projects, which can help to generate new ideas

and approaches, and produce more impactful research outcomes. Collaboration (Hall et al. 2018) can also help to distribute workloads and resources, and access new funding opportunities (McManus et al. 2020a). In the current study, Brazilian authors publishing in local journals, and those studying open access show low networking, especially international collaboration. Networking allows scientists to share their knowledge and expertise with others in their field, and to learn from the expertise of others. This can help to keep scientists up-to-date with the latest research and trends in their field, and to generate new research ideas. Networking can also be important for professional development, as it provides opportunities to learn from more experienced scientists and to gain new skills and knowledge, and can help build one's reputation, which can lead to new opportunities for research funding, publication, and career advancement.

According to Fortunato et al. (2018), in science, social, conceptual, and material elements are connected through formal and informal flows of information, ideas, research practices, tools, and samples. Science is therefore a complex, self-organizing, and constantly evolving multiscale

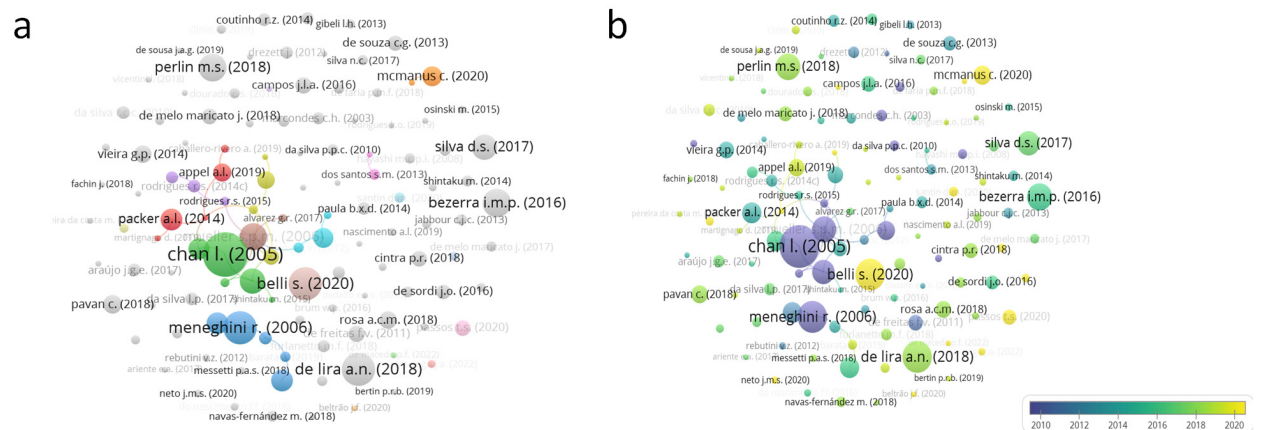


Figure 11. Key Citation Networks and Temporal Citation Patterns in Brazilian Publications about Open Access. Panel (a) shows the network of most-cited papers by Brazilian authors in the field of Open Access, with clusters indicating citation relationships. Panel (b) visualizes the average year of publication for cited works, with the color spectrum indicating older (blue) to more recent (yellow) publications.

network (Kuhn et al. 2014). The network analysis here shows little internal collaboration/networking in this study area between Brazilian scientists, as such opportunities may be lost in advancing the discussion within the country. According to Azevedo (2016), impacts in the humanities are linked to community identity and cohesion (social, policy impact), social networking (social impact), providing innovative content and support for the creative and cultural industries (cultural, economic impact), enhancing public debate (cultural, social, policy impact) as well as informing developments in performance, professional practice or public

policy (economic, policy impact). As can be seen here, several of these factors are lacking.

Funding OA needs to be discussed in Brazil. Larivière & Sugimoto (2018) found important differences in OA percentages and types between funding programmes, agencies and fields of knowledge. De-Castro and Franck (2019) concluded that the transference of OA funding policies to specific institutions might have a positive effect on the overall efficiency of publicly assumed APCs. De Filippo & Mañana-Rodríguez (2020, 2022) showed that, in Spain, OA publications are more cited than non-OA publications different from the Brazilian case.



Figure 12. Key Journals in the Brazilian Publications about Open Access. This map highlights the leading journals where Brazilian authors publish on the topic of open access. The node sizes reflecting the frequency of publication and connecting lines indicating inter-journal citations.

These authors also highlight, the importance of internal university policies for increasing research visibility. Nevertheless, as with De Filippo & Mañana-Rodríguez (2022) the design of OA policies needs to place take into consideration potential reactions of the publication market and impacts on research budgets.

The size and diversity of scientific communities vary greatly depending on the area of knowledge and the relationship between the size and diversity of scientific communities and citation rates is complex and context-dependent, and is influenced by a variety of factors. Some areas of knowledge have large and diverse scientific communities, while others have smaller and more specialized communities. McManus & Baeta Neves (2022) showed that SSH papers have fewer papers per journal, fewer authors per paper and LLA cite fewer papers than the other areas of knowledge. They also take longer to accumulate citations, and the behaviour of citations in SciELO differs

from those in Incites and SciVal. Larger scientific communities may produce more research publications, which can increase the number of potential citations for individual papers. A large and diverse community may also have more researchers with diverse perspectives, which can lead to more diverse research findings that may be of interest to a wider range of readers and researchers.

In general, the size of a scientific community is determined by the number of researchers and institutions working in a particular field, as well as the level of funding and resources available to support research in that field. Some areas of knowledge, such as physics, chemistry, and biology, have large and well-established scientific communities with many researchers, institutions, and funding sources. These communities are often highly collaborative and interdisciplinary, with researchers from different backgrounds and fields working together to solve complex problems.

Table IX. Major journals used for publishing on open access in Brazil.

Source	Documents
Ciência da Informação	47
Transinformação	22
Perspectivas em Ciência da Informação	21
Informação e Sociedade	19
Revista Brasileira de Educação Especial	14
Scientometrics	14
Revista Digital De Biblioteconomia e Ciência da Informação	12
Biblios	9
Educação e Pesquisa	7
Movimento	6
Risti Revista Ibérica de Sistemas e Tecnologias de Informação	5
Texto Livre	5
Educação e Sociedade	4
Education Policy Analysis Archives	4
Interface Communication Health Education	4
Meta Avaliação	4
Revista Espanola de Documentacion Cientifica	4

Some social sciences and humanities fields have smaller and more specialized scientific communities (Mathies et al. 2020). These communities may be more focused on a specific subfield or topic, and may have fewer researchers and resources available to support their work. However, these communities can still be highly impactful and influential, and may have a strong focus on interdisciplinary collaboration and community building as seen in Sivertsen (2016).

However, citation rates are also influenced by other factors, such as the quality and impact of the research, the visibility and accessibility of the publications, and the level of competition within the field. In some cases, smaller and more specialized scientific communities may have higher citation rates for individual papers because the research is highly focused and impactful within that community. Additionally, the size and diversity of scientific communities may affect the level of competition within the field, which can impact citation rates. In a highly competitive field with many researchers and publications, individual papers may be more likely to get lost in the noise and receive fewer citations. In a smaller or more specialized community, there may be less competition for citations, and individual papers may be more likely to stand out and receive more attention and citations.

It is important to highlight that not all research shows global relevance, although it may be regionally important (Mathies et al. 2020). Dewan & Shah (2016), showed that indexing in international databases may be a challenge for regional and national journals, especially those published in native languages. SciELO and Redalyc, two prominent platforms for the dissemination of scientific research from Latin America and the Caribbean, have made significant contributions to the open access

movement (Strehl et al. 2016). These bases mainly focus on scientific journals from Latin America, the Caribbean, Spain, Portugal, and South Africa, hence limiting their scope and reach compared to other international databases. These platforms have not been without their fair share of criticisms and challenges. Some researchers have raised concerns about the visibility of articles published on the platform, suggesting that they may be less visible and less frequently cited than articles published on other international databases. Also, the long-term sustainability of these bases, as they rely on the support of funding agencies and governments in the regions where it operates, is always compromised since it is subject to political and economic instability. Our analysis indicates that the overall quality of publications by Brazilian researchers did not improve, regardless of whether they were published under an OA policy or not. These data also suggest that publishing in high-impact or Global North journals has more relevance to improving the Brazilian science impact than publishing OA.

Knowing that most respectable publishers are currently moving towards OA models, and considering that this is a global trend in all areas of science, the tendency is that scientific indicators such as JIF, %DocCited, and CNCI will not be applicable to compare open and closed access models because the majority of publications will likely be found in OA models in a few years. During this transition, however, the data discussed herein is essential to guide new public policies, especially in the Brazilian context, and to help other developing countries promote their own policies.

Acknowledgments

The authors acknowledge the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), Brazil, and the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq), Brazil and Fundação de

Amparo à Pesquisa do DF (FAPDF) and Fundação Carlos Chagas Filho de Amparo à Pesquisa do Estado do Rio de Janeiro (FAPERJ). The authors declare no conflict of interest.

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SUPPLEMENTARY MATERIAL

Table SI-SII.

How to cite

FIGUEIREDO C, NEVES AAB, PIMENTEL F, PIMENTEL D, MOTA-ARAÚJO HP, DE BEM AF, NETO BAD & MCMANUS C. 2024. Impact of Open Access Policy on Brazilian Science and Global Trends. *An Acad Bras Cienc* 96: e20231068. DOI 10.1590/0001-3765202420231068.

*Manuscript received on September 23, 2023;
accepted for publication on February 4, 2024*

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C.P.F., A.A.B.N., B.A.D.N and C.M. conceived the study. C.P.F., A.A.B.N., F.P, D.P., H.P.M.A., A.F.B., B.A.D.N and C.M. contributed to experimental design and analyzed the data. C.P.F., H.P.M.A., B.A.D.N and C.M. wrote the manuscript. All authors read and approved the final version.

