EDITORIAL

RAE AND OPEN SCIENCE: WHAT'S NEXT?

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RAE AND OPEN SCIENCE

As we enter 2024, the term Open Science is no longer unfamiliar to those engaged in scientific research. The Open Science movement traces its roots back to 1991 when physicist Paul Ginsparg created the arXiv repository to facilitate the sharing of preprints in the field of Physics. Today, numerous international institutions recognize and actively participate in this movement. For instance, the Organisation for Economic Co-operation and Development (OECD) formally embraced Open Science in 2015 (OECD, 2015). Additionally, the United Nations Educational, Scientific and Cultural Organization (UNESCO), in its 2023 report, highlighted that at least 10 of the 17 Sustainable Development Goals (SDGs), established by the United Nations (UN) in 2015, rely heavily on continuous innovation and scientific research. This reinforces the growing significance of Open Science in the pursuit of these goals. Within the scientific community, an array of studies and publications extol the benefits of Open Science across various domains (Aguinis et al., 2017; Chauvette et al., 2019; Martins, 2020; Mendes-Da-Silva, 2019; Miguel et al., 2014; Peci, 2022; Vicente-Saez & Martinez-Fuentes, 2018).

Founded in 1961, *RAE* is one of Brazil's oldest business management journals. Since 2003, *RAE* articles have been available for free access, marking a pivotal Open Science practice aimed at democratizing knowledge. In 2010, *RAE* earned approval from the Journal Citation Reports (JCR) index. By 2016, it had garnered recognition from the Committee on Publication Ethics (COPE) as a global benchmark for quality and academic rigor in scientific research. Subsequently, in 2021, *RAE* proudly joined the esteemed AJG/ABS ranking. *RAE* receives over 500 submissions annually from across the globe, consistently publishing approximately six issues per year, each containing seven to 10 articles. It stands tall as one of the premier business management journals in Latin America.

At the close of 2021, *RAE* embarked on a journey to embrace additional Open Science principles. Beyond its commitment to continuous publication, *RAE* extended invitations to authors and reviewers, urging them to openly share their opinions and identities. Moreover, *RAE* actively encouraged authors to make their data publicly accessible. In a groundbreaking work, Mendes-da-Silva (2023) paved the way for *RAE*'s forthcoming strides in Open Science, underscoring its steadfast dedication to producing and disseminating impactful scientific research relevant to both organizations and society. According to Mendes-da-Silva (2023), Open Science practices serve as a vital cornerstone of scientific inquiry, enhancing the dissemination of research findings and amplifying their societal value while bridging the gap between scientific research and society. Recent empirical evidence corroborates the manifold benefits of such practices, including tangible metrics such as increased citation rates and article submissions, as well as the broader impact experienced within the scholarly community (Aguinis et al., 2017, 2020; McKiernan et al., 2016; Pampel & Dallmeier-Tiessen, 2014).

This editorial aims to introduce, alongside the currently implemented practices, additional Open Science initiatives that *RAE* will gradually adopt starting in 2024. In doing so, *RAE* joins a cohort of journals that have either established themselves as proponents of Open Science or have developed guidelines for its implementation, such as the Journal of Management (Bergh & Oswald, 2020), Journal of International Business Studies (Aguinis et al., 2017), Journal of Finance (Harvey, 2017), Journal of Marketing, Journal of Business Ethics, and Journal of Business Research. Naturally, the dynamic nature of scientific progress and the evolution of best practices in all fields prevent this editorial from adopting a prescriptive tone. Nevertheless, its primary objective is to outline the initial steps *RAE* will take and its medium- and long-term vision for Open Science.

Among the Open Science practices are Open Access, Open Data and Open Materials, Open Code, Open Peer Review, and Pre-registration of Research (see Mendes-da-Silva, 2023).

Currently, all materials published by *RAE* are available through Open Access. This practice facilitates the dissemination of research findings to the entire community and democratizes access to academic literature, eliminating restrictions and financial barriers. Moreover, since 2023, *RAE* has embraced Open Peer Review on a voluntary basis. Authors and reviewers are encouraged to make their evaluations and responses publicly accessible. Notably, the identities of authors and reviewers are revealed only upon acceptance of the article for publication by *RAE*. Recent issues of *RAE* have featured articles that underwent Open Peer Review, including works by Cunha et al. (2024), Graça and Ryngelblum (2024), Sousa and Baltazar (2024), and Toro-García et al. (2024). Additionally, *RAE* imposes no restrictions on the submission of articles previously shared on preprint servers such as Scielo (https://preprints.scielo.org) and SSRN (https://www.ssrn.com). This policy not only enhances the visibility of authors' work but also aligns with recent evidence suggesting that preprinted articles are, on average, accepted more rapidly and have a higher likelihood of acceptance (Kodvanj et al., 2022).

So, what's next?

RAE will implement the following measures to strengthen its Open Science initiatives. These measures will apply to submissions of new articles in 2024 or 2025. Additionally, authors of articles previously published by *RAE* are encouraged to adhere to these practices by making their data or search codes available (in this case, retrospectively).

1. Open Peer Review: Starting July 2024, Open Peer Review will become mandatory for authors of articles accepted for publication. This entails making the identity and content of reviews and responses publicly available. Authors submitting new articles must agree to Open Peer Review at the time of submission. Additionally, the first round of feedback provided by associate editors to authors will also be made public starting on the same date.

   For reviewers of articles accepted, after the acceptance of the final version, Open Peer Review will be optional. Reviewers may choose one of three options: (1) authorize the publication of their feedback and identities, (2) authorize only the publication of their feedback without disclosing their identities, or (3) opt out of making their feedback and identities public.

   To preserve the integrity of discussions and information exchanges between authors, associate editors, and reviewers, *RAE* will refrain from altering feedback or responses. Furthermore, *RAE* commits to assigning unique identification codes (i.e., DOIs) to peer-review documents, publishing them simultaneously with the article's final version. This ensures that authors and reviewers receive recognition for their contributions, which may be cited in future works.

2. Open Data and Open Materials: Commencing January 2025, *RAE* will introduce the practice of Open Data and Open Materials, operating under the principle of "share or explain." Upon submission, authors of new articles will be asked to provide details regarding the nature and source of the data utilized in their research. Data sharing will be mandatory for research data generated by the authors (i.e., primary data) or obtained from freely accessible platforms. While original data sharing is not obligatory for research data gathered through interviews where confidentiality is paramount (personal security or privacy issues, for example), authors must privately share the confidentiality agreement with *RAE*'s Editor-in-Chief. In cases where research data is collected from private platforms requiring paid access, authors are required to justify the non-sharing, which may include the absence of ownership rights over the data. Additionally, if the submitted article reuses data from previously published scientific research, citing the original source is mandatory. Table 1, Panel A, delineates the various data types and the policy *RAE* will implement.

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3. Open Code: Starting January 2025, *RAE* will implement the practice of Open Code. Authors of new submissions will be required to share the codes utilized for tabulation or data analysis, such as scripts generated for R software or do-files for Stata software, among others. It is recommended that code sharing be conducted in a separate document rather than as an appendix to the original submission. Additionally, research protocols generated in bibliometric research and/or systematic reviews must also be shared. Panel B of Table 1 outlines *RAE*'s policy regarding research codes and protocols.

4. Pre-Registration of Research: Effective January 2025, *RAE* will begin accepting research submissions for pre-registration. Articles submitted in this format must adhere to *RAE*'s author guidelines, except that they should not include a results section. As the nature of pre-registered research implies, data collection and analysis cannot have been completed at the time of submission. Nonetheless, contributions to the field of Business Management need to be clearly outlined. Similar to full articles, submissions for pre-registration will undergo the peer review process, which may result in either (1) approval with the condition that the pre-registered protocol is followed or (2) rejection. Upon approval for pre-registration, authors may proceed with data collection and analysis as outlined in the initial submission. Following the final analysis, the complete article will be resubmitted to *RAE* for peer review, evaluating whether it aligns with the pre-registered protocol. Authors should consider feedback from peers regarding the final version of the article, including results and conclusions. Ultimately, if the final article adheres to the pre-registered protocol, it will be approved for publication, irrespective of the outcomes.

    Pre-registered research offers several advantages over other approaches. By submitting the study or analysis plan for pre-registration, authors enhance the replicability of their results, thereby bolstering the research's transparency and credibility. Additionally, pre-registered research mitigates the risk of HARKing (Hypothesizing after results are known), preventing authors from selectively and arbitrarily altering their hypotheses or analysis plans. Moreover, pre-registered research serves as a valuable guide for future studies, as the pre-registered protocol accompanies the final version of the research. This not only expands the reach of the research but also fosters a collaborative environment for researchers, particularly those in the early stages of their careers.

Table 1. *RAE's* guidelines for data sharing

Nature	RAE Policy	Example
Panel A – RAE policy regarding sharing research data		
Primary data obtained under conditions of confidentiality	Explanation for not sharing; sharing the condition of confidentiality with the Editor-in-Chief	Data collected in interviews or questionnaires in which the interviewee accepts participation only under condition of confidentiality
Primary data not subject to confidentiality	Mandatory sharing	Data collected in interviews or questionnaires; data created from experiments; simulation data
Secondary data collected from accessible sources	Mandatory sharing	Data collected free of charge on government platforms or private institutions' platforms
Secondary data collected from paywalled sources	Mandatory sharing or explanation for not sharing	Data collected on a private platform with paid access
Reused data	Mandatory source citation	Data collected by third parties and previously used in scientific research
Panel B – RAE policy regarding sharing research materials		
Codes, programs and research protocols	Mandatory sharing	Codes used in statistical programs created to treat and/or analyze data

What is the process for the next steps?

While the Open Science movement is widely supported by researchers across various fields of knowledge (Ross-Hellauer et al., 2017), there remain perceived barriers among authors and reviewers that hinder the adoption of these practices (Houtkoop et al., 2018). Additionally, there is considerable heterogeneity in the level of familiarity that authors and reviewers have with these practices. Therefore, to aid future submissions, we offer a list of best practices at different stages of the research process. Although these practices are not mandatory, we believe they facilitate adherence and enhance the article's contribution in line with the principles of Open Science.

Open Science & Open Data author's Declaration

RAE will require authors to complete the Open Science and Open Data Declaration at the time of a new submission. This document is important to establish the initial link of what authors of new submissions can expect from *RAE* concerning Open Science practices.

Best practices for Storing and Organizing Databases

Empirical research is inherently reliant on the quality of data analysis conducted. Thus, authors must adhere to a systematic approach to data storage and organization. These steps are crucial

for ensuring the proper utilization of data and upholding the integrity and credibility of research findings. Preserving the original data in its collected state is highly recommended. This enables the possibility of restarting analyses from the beginning and enhances the authors' credibility with third parties. While data cleaning is essential for research, tasks such as removing duplicate values and standardizing measurement units should preferably be executed using code or within the research protocol without altering the original data files. In cases where the original data source is not accessible, creating a "readme.txt" file with comprehensive explanations regarding data collection, variable descriptions, format, etc., is advisable. If saving intermediate data files becomes necessary, authors should ensure this is done through code or within the research protocol. Lastly, authors are encouraged to establish a personal system for version control of their databases. This practice facilitates self-management, minimizes the need for redundant work, and promotes collaboration among research team members.

Best Practices for Generating Research Codes

When you have some type of process or task automation, it is often said that "garbage in, garbage out (GIGO)." In the case of academic research, this expression refers to the idea that it is essential to ensure the quality of automatable intermediate steps in research. Whenever the researcher fails to ensure the quality of the processes, the results are invariably not very credible.

Researchers must develop efficient and transparent codes and protocols to uphold the quality of scientific research analyses and prevent GIGO. This not only ensures the credibility of their analyses but also facilitates reproducibility. Authors should acknowledge that others will review their codes in the future, necessitating good structure and organization, often accompanied by comments and explanations at critical junctures in the code. Such practices aid in maintenance and self-management for programmers and enhance comprehension for third parties. It is imperative to provide detailed explanations for specific functions or lines of code whenever feasible or necessary. Clear comments featuring logical and didactic explanations behind operations are recommended in such instances. Furthermore, using simple yet descriptive variable names fosters understanding and enhances readability for others reviewing the code. Authors must verify that all lines of code execute without errors from start to finish at the time of submission, regardless of when the analysis was initially conducted. Maintaining preliminary code versions on platforms like Github (https://github.com/) or similar services is indispensable for tracking changes made over time.

Best Practices for Pre-Registration Research

Typically, research submitted for pre-registration is more concise in scope and size compared to completed research. However, the work must encompass the following components: 1) Underlying theory and research questions; 2) If applicable, research hypothesis(es); 3) Detailed description

of participants and/or respondents when necessary; 4) Description of the sample and variables to be observed, measured, or collected; 5) Comprehensive description of the empirical design, including details on questionnaires and/or interviews, content analysis, variable measurement, strategies for identifying and mitigating the effects of outliers, etc; 6) Data tabulation plan and other data analysis procedures. While the components above are necessary for pre-registration approval, their mere presence does not guarantee approval. In addition to these components, research submitted for pre-registration must demonstrate its contribution to the literature and elucidate its potential implications for academia and business management practice. Authors are encouraged to explore online pre-registration services such as https://aspredicted.org/ and https://osf.io/ to define the content and format of their proposal (Logg & Dorison, 2021).

Best Practices for Open Peer Review

Recently, Ross-Hellauer et al. (2017) found that most participants in their research advocate for open peer review to become a more prevalent practice. One of the key findings is that the disclosure of reviewers' identities should be voluntary to prevent impeding their impartial assessment and assuage concerns about potential reprisals from authors. Nevertheless, the majority of respondents in Ross-Hellauer et al.'s study (2017) concur that the open exchange of viewpoints is beneficial for enhancing article revision. Henceforth, *RAE* encourages both authors and reviewers to share their comments openly, accessible not only to their immediate counterparts but also to the broader public, in a transparent and unrestricted manner. This approach naturally underscores the importance of fostering cordiality and mutual respect in written communication and prompts authors and reviewers to be candid and constructive in their feedback. Additionally, open peer review encourages authors and reviewers to acknowledge the educational value this practice can offer to the scholarly community, particularly to those newer to the field.

Best Practices for Data Reuse

As the adoption of Open Data and Open Sources continues to progress and more articles make their data available, it becomes increasingly crucial to establish good practices for reusing this data in subsequent research endeavors. Alongside adhering to best practices for storing and organizing databases, the initial step is not only to fully cite the original article and data source but also to appropriately acknowledge the original and responsible authors for their initial data collection efforts. Furthermore, data reuse requires comprehensive documentation of any modifications made to the original database and any additional data collected subsequently. Lastly, it is considered good practice for authors of articles to reuse data to establish transparent and responsible communication channels with the original authors. This facilitates efforts toward replicability and ensures integrity throughout the research process.

RAE's next steps in adhering to Open Science

As *RAE* enters 2024, it recognizes the imperative for science to bridge the gap with society, serving as a catalyst for transformation and economic progress. Open Science embodies a set of practices that enhance dialogue: 1) between research producers and consumers and 2) among the diverse stakeholders within the scientific research ecosystem. By embracing Open Science principles, *RAE* reaffirms its commitment to fostering transparency, accessibility, democratization, accountability, and collaboration among authors, reviewers, and readers. This not only bolsters trust in scientific research but also accelerates innovation and societal development.

The expansion of *RAE*'s Open Science practices instills optimism among authors, reviewers, and readers alike. For instance, broader adoption of data and code-sharing fosters greater transparency and accessibility, benefiting both individuals and society. This enhances published research's breadth and practical impact across various societal domains. Moreover, facilitating open communication between authors and reviewers nurtures broader professional networks, facilitates new research partnerships and potentially enhances performance metrics, such as citation rates. By advocating for the free availability of research materials, *RAE* solidifies its role as a transformative force in society, facilitating evidence-based decision-making in organizations and addressing real-world problems.

While 2024 presents its share of challenges and the consolidation of existing practices, it is also a transitional period following the introduction of new practices slated for implementation in July 2024 and January 2025. Consequently, we invite all stakeholders to acquaint themselves with these evolving changes to further democratize the academic research landscape and advance *RAE*'s mission within its community.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

AUTHORS' CONTRIBUTION

Henrique Castro Martins: Conceptualization; Data curation; Formal analysis; funding acquisition; Investigation; Methodology; Project administration; Resources; Software; Supervision; Validation; Visualization; Writing – original draft; Writing – proofreading, and editing.

Wesley Mendes-da-Silva: Conceptualization; Data curation; Formal analysis; funding acquisition; Investigation; Methodology; Project administration; Resources; Software; Supervision; Validation; Visualization; Writing – original draft; Writing – proofreading, and editing.