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Scientific data governance and authorship policy in transdisciplinary research and innovation environmental projects

Governança de dados científicos e política de autoria em projetos ambientais de pesquisa e inovação transdisciplinares

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Abstract

Effective scientific data governance and equitable authorship attribution are essential to the success of large-scale, transdisciplinary research initiatives. Drawing on our experience in two major programmes, namely "Damage Diagnosis Programme following the Brumadinho dam disaster" in the Paraopeba River basin (PDD) and "IBI UHE-Furnas & UFMG" project, in the Grande River basin; each involving hundreds of investigators from academia, industry and civil society, we developed and implemented a comprehensive governance model. Core components include (1) field data collection with standardised protocols, which are curated to maintain consistency, reliability and reproducibility and (2) a structured authorship policy, which needs to be as objective as possible and guarantee fairness of credit among participants. We thus developed a policy based on the CRediT taxonomy, where we require least four contributorship roles (including writing as a mandatory one) for authorship and offering co-authorship eligibility to those meeting four roles; and a diverse Scientific Committee to oversee proposal review, manage conflicts of interest and prevent redundant research. All manuscripts must undergo centralised submission and use only validated datasets, while acknowledgements and compliance statements align with relevant data-protection and ethical regulations. Implementation of this framework has clarified contributor roles, mitigated gift and ghost authorship, fostered transparent workload distribution and enhanced inclusivity, particularly for early-career and under-represented researchers. Our findings demonstrate that a deliberately flexible yet rigorous governance-and-authorship policy can balance autonomy, fairness and accountability. This model provides a replicable blueprint for other large, collaborative research programmes seeking to fairly uphold integrity, promote diversity and accelerate trustworthy scientific discovery.

Keywords: scientific writing, scientific publication, ethics, research, innovation, compliance

Resumo

A governança eficaz de dados científicos e atribuição equitativa de autoria são essenciais para o sucesso de iniciativas de pesquisa transdisciplinares em larga escala. Com base em nossa experiência em dois programas principais — o "Programa de Diagnóstico de Danos após o desastre da barragem de Brumadinho" na bacia do rio Paraopeba (PDD) e o projeto "IBI UHE-Furnas & UFMG" na bacia do rio Grande —, cada um envolvendo centenas de pesquisadores da academia, indústria e sociedade civil, desenvolvemos e implementamos um modelo abrangente de governança. Os componentes centrais incluem: (1) coleta de dados de campo com protocolos padronizados, que são curados para manter consistência, confiabilidade e reprodutibilidade; e (2) uma política estruturada de autoria, que deve ser o mais objetiva possível e garantir a distribuição justa de créditos entre os participantes. Assim, desenvolvemos uma política baseada na taxonomia CRediT, exigindo pelo menos quatro funções de contribuição (incluindo obrigatoriamente a redação) para elegibilidade de autoria, e oferecendo coautoria àqueles que cumprirem esse critério. Um Comitê Científico diverso supervisiona a revisão de propostas, gerencia conflitos de interesse e previne pesquisas redundantes. Todos os manuscritos devem passar por submissão centralizada e utilizar apenas conjuntos de dados validados, enquanto agradecimentos e declarações de conformidade seguem as normas pertinentes de proteção de dados e ética. A implementação deste modelo esclareceu os papéis dos colaboradores, mitigou práticas de autoria fantasma e presenteada, promoveu uma distribuição transparente de trabalho e aumentou a inclusão, especialmente de pesquisadores em início de carreira e de grupos sub-representados. Nossos resultados demonstram que uma política de governança e autoria deliberadamente flexível, porém

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rigorosa, pode equilibrar autonomia, justiça e responsabilidade. Este modelo oferece um plano replicável para outros programas colaborativos de pesquisa que busquem manter com justiça a integridade, promover a diversidade e acelerar descobertas científicas confiáveis.

Palavras-chave: redação científica, publicação científica, ética, pesquisa, inovação, conformidade

1. Introduction

As research becomes increasingly data-intensive, robust governance frameworks are essential to ensure transparency and reproducibility. The Organisation for Economic Co-operation and Development (OECD) defines data governance in research as the frameworks to manage data throughout its value cycle, from creation to deletion, across policy domains, balancing the benefits of openness with privacy, intellectual property and security concerns (OECD, 2022). To operationalize these goals, the FAIR Principles (Wilkinson et al., 2016) propose that data, algorithms, and workflows be Findable, Accessible, Interoperable, and Reusable (FAIR), thereby maximizing their utility for both human and machine-driven research. Here, we share experience from two transdisciplinary research and innovation monitoring projects - characterized by both extensive territorial coverage and the involvement of a large number of researchers, namely “Damage Diagnosis Program following Brumadinho dam disaster” (PDD) and “IBI UHE-Furnas & UFMG”. These initiatives encompassed not only the collection, analysis, sharing, and publication of extensive datasets, but also the coordination of individuals from multiple disciplinary and institutional backgrounds and authorship cultures, spanning all sectors of society. Also, they include universities, private companies, civil society, government agencies, and other key stakeholders. Among our core objectives, these guidelines aim to inform a governance policy that codifies responsibilities, standardises processes and embeds ethical practices towards data usage and its publication. More broadly, we want to share our experience for an objective and fair policy for data and authorship management, which needs to be inclusive and provide opportunities for increasing diversity in scientific and outreach publications (Hinnant et al. 2012, Adams 2013, Freeman and Huang 2014, Powell 2018). In addition, the methodological design applied throughout these projects is anchored in a transdisciplinary perspective, integrating tools and approaches from the environmental sciences more broadly. This approach supports integrated diagnostics and provides a flexible framework for participatory governance, bridging scientific, regulatory, and societal domains.

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2. Data Governance as a Pillar of Research Integrity

2.1 Policy and Regulatory aspects

The OECD's "Going Digital" initiative highlights data as a key driver of economic and social value, advocating for coherent governance frameworks that promote data sharing while safeguarding individual rights (OECD 2022). These principles have been increasingly adapted to publicly funded research, ensuring that datasets generated through government grants are accessible and reusable under clear terms. A foundational requirement in this context is the collection of data through rigorous sampling design and governance practices using standardized formats, for example, employing uniform datasets and formats, using controlled vocabularies, and automating processing via open-source software (e.g., Wieczorek et al. 2012, R Core Team 2024). Such practices are critical for ensuring data consistency, traceability, and reproducibility. They also mitigate the risk of undocumented modifications, facilitate audits, and enable more efficient collaborative analyses

All projects in any context must hold strict adherence to regulatory compliance. This requires obtaining all requisite permits, licenses, and ethical approvals from relevant federal, state, municipal, and private governing bodies prior to project initiation. Furthermore, everyone engaged in such transdisciplinary research activities; specially those funded by private companies; need to abide specific regulations defined by their respective professional councils. This requirement ensures compliance with national regulatory and ethical standards, while securing the legitimacy of professional contributions across disciplines.

2.2 Operational Framework and Standard Procedures for Data Governance

To ensure consistency, traceability, and accountability throughout the data lifecycle, our environmental data governance strategy integrates a robust operational framework supported by formalised Standard Operating Procedures (SOPs). This approach enables multidisciplinary research teams to manage data from collection through analysis, curation, and dissemination in a transparent and replicable manner (Gibert et al. 2018, Sudmanns et al. 2020).

The framework accommodates both primary data, gathered in the field with digital tools, and secondary data, obtained from existing repositories and literature. Secondary datasets are harvested, documented and, where necessary, pre-processed before integration. All such

datasets are accessed and reused strictly in accordance with the licences and terms of use stipulated by each source repository, (e.g., Creative Commons licences www.creativecommons.org/licenses/, GBIF three-tier policy www.gbif.org/terms). After ingestion, every dataset passes through validation, transformation and continuous curation to meet the quality thresholds required for long-term storage, analysis and reuse (Farley et al. 2018, Burnette 2022).

These processes are governed by detailed SOPs covering field protocols, metadata standards, data validation routines, and authorship attribution criteria. The SOPs are version-controlled, regularly updated by technical leads and the Scientific Committee, and aligned with evolving methodological, regulatory, and ethical requirements (Burnette 2022). This ensures continuity in practice, supports onboarding and training of new team members, and fosters long-term data stewardship.

By embedding procedural rigour and digital integration into data workflows, this framework reinforces compliance with national legislation such as Brazil's General Data Protection Law (LGPD) and aligns with international best practices for ethical and sustainable research data management (OECD 2022; Wilkinson et al. 2016; Gasser and Almeida 2017).

3. Authorship Attribution via CRediT Taxonomy

3.1 Rationale for Role-Based Attribution

Authorship attribution in academic publishing remains highly subjective, lacking quantitative thresholds, which ultimately leads to inconsistent application of criteria across disciplines and institutions and across different degree's levels (Savchenko and Rosenfeld 2024). Among the most problematic forms of misconduct are *gift authorship* – where individuals receive unwarranted credit – and *ghost authorship* – where substantial contributors are omitted (Mowatt et al. 2002). Power imbalances exacerbate these issues: senior researchers may – even unintentionally – leverage authority to claim authorship or compel inclusion, while junior staff, fearing retaliation, acquiesce to inequitable arrangements (Smith 1994). Such practices fuel disputes over author order and credit, often without clear institutional mechanisms for resolution. While the Committee on Publication Ethics (COPE) requires that authorship disputes be resolved by home institutions, these mechanisms risk perpetuating systemic biases, particularly in collaborations between Global North and South institutions.

The failure to credit legitimate contributors undermines career progression, since publications drive hiring and funding decisions, and erodes trust in the scholarly record when accountability is obscured (Zimba and Gasparyan 2020). Moreover, some groups, including early-career researchers and under-represented minorities are disproportionately affected by authorship malpractice, compounding systemic inequities (Zimba and Gasparyan 2020). To address these challenges, the adoption of transparent attribution systems such as the Contributor Roles Taxonomy (CRediT – https://credit.niso.org/) offers a structured approach to clearly document the specific contributions of individuals involved in scholarly research and uphold the integrity of research outputs (Cooke et al. 2021). While the Contributor Roles Taxonomy (CRediT) is not designed to define authorship eligibility, it serves as a valuable tool for analysing individual contributions within specific research projects. By detailing 14 distinct roles in research involvement, CRediT provides a structured framework to transparently document each contributor's involvement along the development of the research process.

3.2 Adoption and Impact

Over 100 publishers, including BMJ, Elsevier, Willey, Springer Nature, eLife and the American Association for Cancer Research, have integrated CRediT into submission workflows, improving visibility of specific contributions and elevating credit for non-writing tasks such as Software and Validation. Although CRediT was not originally intended to define authorship eligibility, our experience shows that it can effectively support a more objective attribution of individual contributions within transdisciplinary research and innovation projects. This insight can inform discussions on workload distribution and recognition within collaborative research efforts. Moreover, utilizing CRediT facilitates the identification of patterns in contributor roles, which can be instrumental in addressing issues related to authorship disputes and ensuring equitable credit allocation. By making contributions explicit, it becomes easier to acknowledge the work of all participants, including those whose efforts might otherwise go unrecognized, such as fieldwork, laboratory analyses, software development and so on, given they also contribute in other intellectual steps (Allen et al. 2014, Brand et al. 2015, Ding et al. 2021). Thus, in our experience, while CRediT does not originally intend to determine who qualifies for authorship, its implementation has enhanced transparency, fairness, and accountability among team members. It complements pre-existing authorship cultures and definitions within the several research groups involved, by providing a

systematic way to document and evaluate contributions, thereby reducing ambiguity and averting conflicts (Allen et al. 2014).

Moreover, while originally developed within specific institutional contexts, this approach has shown strong potential for adaptation and replication across diverse settings, including governmental and private sectors, research, development, and innovation (RDI) initiatives, and university–society outreach programs. By adopting a structured yet flexible authorship and governance framework, new research groups working at multiple scales can incorporate these principles into their own collaborative strategies, fostering comparative analyses and strengthening trans-institutional monitoring networks.

To ensure transparent and equitable authorship attribution, our team established a structured framework aligned with the CRediT (Contributor Roles Taxonomy) guidelines. For each manuscript produced, the lead author is responsible for applying the CRediT taxonomy to clearly delineate individual contributions. Authorship eligibility requires fulfilment of at least four CRediT criteria, from which participation in writing, either through original draft preparation or substantial review and editing, is mandatory. Eligible contributor roles are those described in CrediT, namely conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing – original draft, writing – review & editing. In our experience, we adopted that researchers who contribute to at least four roles are considered eligible for co-authorship, provided that taking part in the manuscript writing process is one of the criteria met. This approach tries to ensure more objectively that intellectual contributions are aligned with authorship accountability. The threshold was not arbitrarily defined but emerged from a consensus-based workshop involving the entire research team, during which project-specific factors such as interdisciplinary scope and data complexity were evaluated to establish appropriate authorship standards. The framework retains flexibility, allowing adaptation to the specific demands of each project while maintaining integrity in the attribution of scholarly credit.

Every publication proposal needs to be submitted to a scientific committee via a dedicated online form to ensure its functionality and transparency among project members. Only data validated by the research teams can be used, thus ensuring that all analyses are based on verified datasets and that no undesired overlaps occur.

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4. Establishing a scientific Committee and its roles

Research teams typically consist of diverse individuals with varied expertise, backgrounds, and professional objectives. While working toward common project goals, each researcher naturally maintains their own scholarly priorities and publication timelines. Consequently, it is natural for publication demands to become highly heterogeneous over the course of the project, encompassing everything from conference papers to review articles, as well as master's degree dissertations and PhD theses. Without systematic coordination, such unmatched timelines and output types can create inconsistencies that may lead to conflicts and project delays.

To ensure consistent application of authorship criteria and systematic documentation of all research outputs across subprojects, we established a Scientific Committee comprising project members deliberately selected to represent epistemic diversity in the team. The committee's composition aims at reflecting multidimensional inclusivity, incorporating representation across academic career stages, gender identities and ethnic and geographical backgrounds. This governance structure serves both normative and instrumental purposes by safeguarding equitable attribution practices while maintaining comprehensive output tracking. Guaranteed top academic competence, this diversity is necessary and contributes in fostering inclusive and equitable decision-making processes (Hinnant et al. 2012, Powell 2018). The committee's core responsibilities include receiving, evaluating, and analysing research and manuscript proposals, ensuring that each submission aligns with the overarching objectives and standards defined for the project, both by funders and member-defined policies. Additionally, the committee plays a key role in identifying and moderating potential conflicts of interest that may arise during the proposal review process. Finally, it must ensure that no member has a conflict of interest or holds sufficient influence to compromise the committee's impartiality and make sure that no representative is subject to command chains by virtue of status, under penalty of undermining its diversity.

Another critical function is the detection of overlapping research and manuscript proposals as early as possible, thereby fostering efficient use of resources and encouraging innovative, non-redundant research endeavours. While the committee provides oversight and ensures compliance with governance standards, it deliberately refrains from dictating the internal composition and order of authorship within research teams. This policy respects the autonomy of individual research groups, allowing them to determine authorship arrangements that

accurately reflect each member's contributions, provided these decisions are made transparently and in accordance with established ethical guidelines.

Furthermore, the initiative of a committee must account for the financial implications of establishing and sustaining such governance framework. In designing the project, it’s necessary to plan sufficient resources for the Scientific Committee’s operations, the design and maintenance of a centralized research database, and the dissemination of publications. Embedding a comprehensive data-governance strategy across all these components ensures the integrity, security, and accessibility of project data, while facilitating compliance with ethical and regulatory requirements.

5. Acknowledgements and compliance

To ensure compliance with the requirements of funders, academic institutions, corporate partners, and ethical oversight bodies, a standardised acknowledgement statement was developed for inclusion in all research outputs, particularly scientific publications, but not limited to them. This statement covers key elements such as funding information, permits obtained for the research (e.g., environmental agencies, ethics committees, private property access allowances whenever necessary and management of genetic heritage), and any other additional institutional or regulatory approvals required. Furthermore, publications should align with research integrity policies that are akin to frameworks such as those regarding sensitive or intellectual property. These include specify requirements for data sharing, access restrictions and budgeting for data stewardship, ensuring that information is handled responsibly throughout the research lifecycle.

6. Conclusion

This article presents a replicable governance model for complex, transdisciplinary research initiatives, grounded in structured data stewardship, transparent authorship attribution using the CRediT taxonomy, and inclusive oversight via a diverse Scientific Committee. Together, these elements promote a balance between scientific rigour, fairness, and autonomy. We expect this paper can serve as a foundation for future research groups and projects to leverage the experience it conveys; providing a blueprint for establishing a transparent, robust, and functional agreements among all participants during their planning phase.

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The implementation of the CRediT taxonomy has enhanced clarity in contributor roles, mitigating common authorship disputes and promoting equitable recognition of all team members' efforts. This structured attribution aligns with best practices in research integrity and supports the professional development of researchers across varying career stages. Beyond the authorship framework, these practices are fully coherent with the United Nations Sustainable Development Goals (SDGs – https://sdgs.un.org/goals). In particular, adopting transparent authorship and rigorous data governance directly advances SDG 16 (Peace, Justice and Strong Institutions) by addressing targets 16.6 (develop effective, accountable, and transparent institutions) and 16.7 (ensure responsive, inclusive, participatory, and representative decision-making at all levels). Moreover, in the context of the global environmental crisis, it is imperative that academic and corporate stakeholders also commit to target 16.A, which mandates ensuring public access to information and protecting fundamental freedoms in accordance with national legislation and international agreements. Finally, by fostering multisectoral partnerships, this framework contributes to SDG 17 (Partnerships for the Goals), specifically target 17.G, which calls for enhancing global partnerships for sustainable development, thus underscoring the necessity for public and private institutions to publish and share all data generated by environmental projects, guaranteed sensitive data, for the benefit of society.

In summary, this governance model, anchored in rigorous data stewardship, transparent authorship via CRediT, and inclusive oversight by a diverse Scientific Committee, offers a concrete, adaptable blueprint for complex, transdisciplinary research. By aligning with ethical standards, Brazil's General Personal Data Protection Law LGPD compliance, and the UN Sustainable Development Goals, it not only strengthens institutional accountability and collaboration but also ensures that data and authorship practices remain fair, transparent, and accessible. As a lasting legacy, this framework empowers future research teams to enter their projects with a pre-established, robust agreement that fosters trust, mitigates conflict, and accelerates sustainable innovation. Given the increasing complexity of collaborative research environments, particularly in contexts marked by regulatory scrutiny, institutional heterogeneity, and environmental sensitivity, the adoption of structured authorship models, is not merely a matter of good practice, but a strategic move. It allows institutions to formalize accountability, prevent authorship disputes, and support coherent, transparent publication workflows in high-stakes scientific settings. Amid an accelerating environmental crisis and

intensifying global change, accessible, transparent, and interoperable high-quality data are critical for guiding adaptive management and bolstering resilience in vulnerable territories.

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Annex 1.

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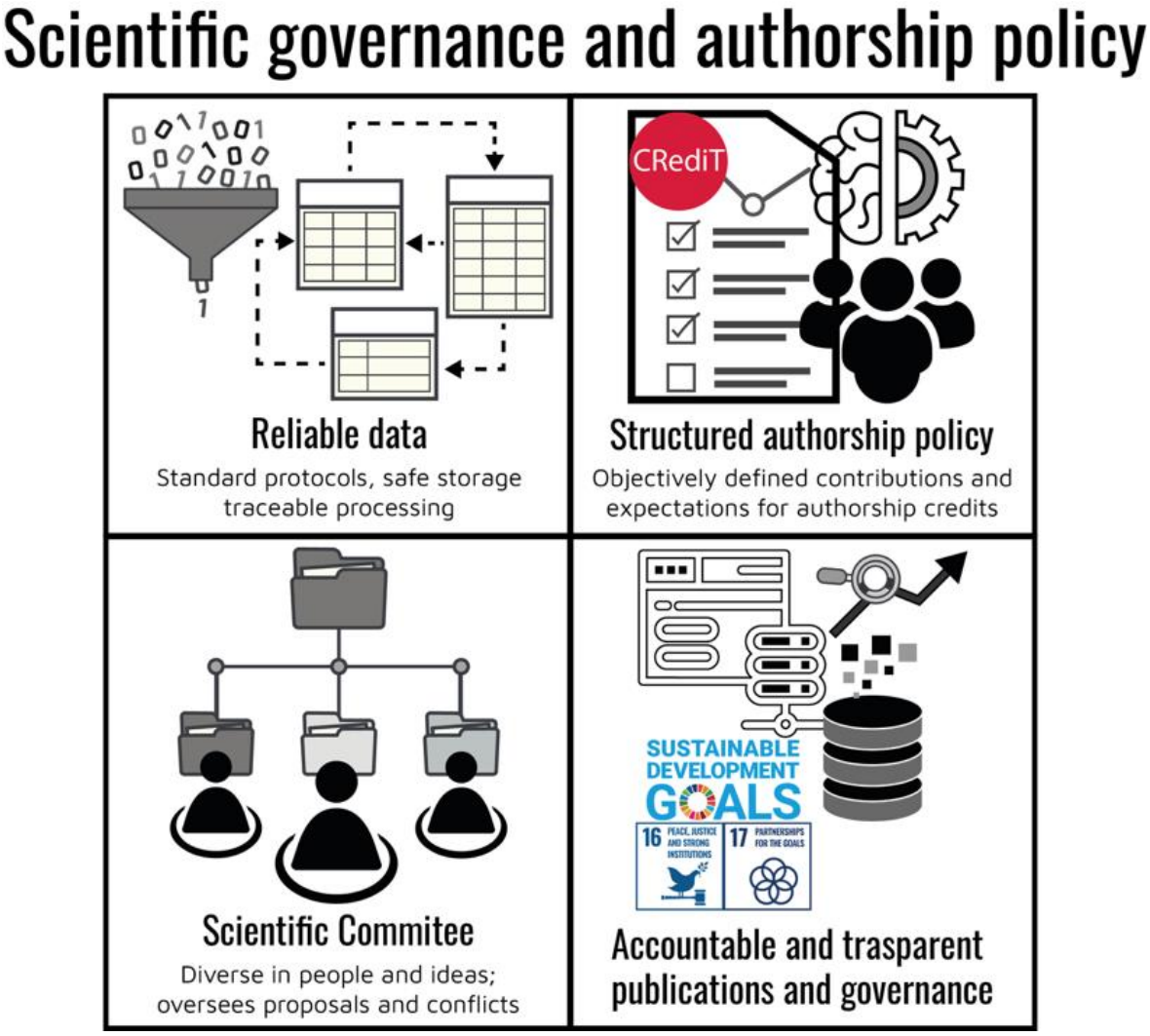
Annex 2.

Figure 1. Scientific governance and authorship policy



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