

Open Infrastructures for Responsible Research Assessment: Principles and Framework

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COARA WORKING GROUP – TOWARDS OPEN
INFRASTRUCTURES FOR RESPONSIBLE RESEARCH ASSESSMENT
(OI4RRA)

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List of Acronyms

CoARA	Coalition for Advancing Research Assessment
WG	Working Group
OI4RRA	CoARA Working Group on Towards Open Infrastructures for Responsible Research Assessment
OI	Open Infrastructure
RRA	Responsible Research Assessment
FAIR	Findable Accessible Interoperable Reusable

Preamble

Effective research assessment is fundamental to the advancement of scientific progress, shaping funding decisions, career trajectories, and institutional strategies. However, traditional evaluation models, often reliant on **closed, proprietary infrastructures and rigid, publication-based metrics**, fail to capture the full range of scholarly contributions to knowledge, policy, and society. As demands for reform grow, there is a pressing need to **transition to transparent, inclusive, and Responsible Research Assessment (RRA) practices** that reflect the **diversity and complexity** of the research enterprise as a whole.

This transition **cannot be built upon closed infrastructures**. In an era of Open Science, relying on **opaque and restrictive, proprietary systems driven by profit-oriented commercial imperatives**, fundamentally contradicts the very principles of openness and RRA. It is crucial to recognize that these systems are not only proprietary but are also driven by for-profit imperatives that prioritize revenue over transparency and accountability. Commercial systems refer to proprietary systems driven by profit-oriented commercial imperatives, closed-source research platforms controlled by for-profit entities, lacking the transparency and community governance of open infrastructures. **This focus on commercial imperatives often result in the concentration of power over research data and scholarly communication, thereby compromising the public interest.** The increasing commercialization of academic infrastructure by major publishers raises significant concerns about their growing control over research data and scholarly communication, underscoring the need to advocate for institutional control over these critical resources¹. Open Infrastructures (OIs) provide the **only sustainable and trustworthy path forward**. They embed **transparency, community governance, democratization, inclusion² and interoperability** as core attributes, ensuring that research assessment practices evolve in alignment with the needs of the scholarly community. However, for this transition to be successful, **OIs must not only replace existing systems, they must surpass them**

¹ Aspesi, C., Allen, N. S., Crow, R., Daugherty, S., Joseph, H., McArthur, J. T., & Shockey, N. (2019, March 29). SPARC Landscape Analysis. , <https://doi.org/10.31229/osf.io/58yhb>

² Leiden Madtrics. Alysson Mazoni and Rodrigo Costas. *Towards the Democratisation of Open Research Information for Scientometrics and Science Policy: The Campinas Experience*. June 06, 2024. [Towards the democratisation of open research information for scientometrics and science policy: the Campinas experience - Leiden Madtrics](#); Dominique Babini, Arianna Becerril Garcia, Rodrigo Costas, Lautaro Matas, Ismael Rafols, and Laura Rovelli. *Not only Open, but also Diverse and Inclusive: Towards Decentralised and Federated Research Information Sources*. April 22, 2024. [Not only Open, but also Diverse and Inclusive: Towards Decentralised and Federated Research Information Sources - Leiden Madtrics](#)

Executive Summary

The CoARA Working Group on Open Infrastructures for Responsible Research Assessment (OI4RRA) was established in November 2023 to define the role of OIs in RRA and provide recommendations for their adoption. Comprising 80 experts from 50 organizations, the group operates under a 24-month mandate to identify the key characteristics and principles that OIs must meet to support RRA, address gaps and challenges in transitioning from proprietary to OIs, and ensure that these systems remain transparent, inclusive, and aligned with evolving research assessment needs.

Building the Blueprint for Open Infrastructures Fit for Responsible Research Assessment

This report is one of the first outputs of the COARA OI4RRA Working Group, setting the foundation for the principles behind OIs in RRA, their unique contributions, and their essential characteristics. It provides a structured framework for leveraging OIs to support a fair, responsible, and future-proof research assessment system. Specifically, it outlines:

- **The critical role of OIs** in ensuring transparent, equitable, and responsible assessment.
- **The essential characteristics that OIs** must possess to surpass the capabilities of proprietary systems.

In addition to emphasizing transparency, the report strongly advocates for inclusion, democratization, and active participation³. This report will be followed by complementary outputs from the Working Group, including a report on transition experiences (highlighting both enablers and challenges and providing strategic recommendations), a toolkit for assessing the suitability of OIs, a conceptual architecture positioning institutional and national investments, and a schema to describe all key characteristics of an OI4RRA, developed in cooperation with [GraspOS](#), which will translate this schema into a registry to help stakeholders discover, evaluate, and engage with OIs that best suit their research assessment needs.

The Case for Open Infrastructures in Research Assessment

The way we assess research directly shapes scientific progress, funding allocations, career advancement, and institutional strategies. Yet, many current systems rely on closed, proprietary infrastructures that fail to reflect the diversity, complexity, and evolving nature of contemporary research.

³ This reflects the vision of Sabina Leonelli, who argues for moving the reasoning and justification of open science from mere transparency to a more inclusive approach (see: <https://www.cambridge.org/core/elements/philosophy-of-open-science/0D049ECF635F3B676C03C6868873E406>).

These legacy systems are fundamentally misaligned with the CoARA principles, which call for recognizing a broader range of research contributions, using both qualitative and quantitative indicators, and ensuring transparency, equity, and inclusiveness in evaluation practices. Proprietary infrastructures hinder progress on these fronts by reinforcing bias, obscuring evaluation criteria, and limiting access and participation.

OIs offer a pathway to **operationalize CoARA's vision**. OIs are transparent, community-governed, and built for interoperability. They support:

- **Recognition of diverse outputs** by enabling the structured representation of datasets, software, training materials, and societal engagement.
- **Use of qualitative and quantitative indicators**, through rich metadata and the integration of narrative CVs and context-aware or domain-sensitive metrics.
- **Transparency and accountability**, by allowing open audit trails, reproducible assessments, and community oversight.
- **Inclusiveness and participation**, by providing equitable access and reducing reliance on commercial gatekeepers.

However, making this transition successful requires intentional investment, strong governance, and well-defined standards to ensure that OIs do not simply replace traditional infrastructures but fundamentally improve upon them.

Characteristics of Open Infrastructures Fit for RRA

To meet the diverse needs of the research community, OIs must integrate ethical, sustainable, and adaptable practices. The report groups these characteristics into four key pillars:

Technical Robustness

Open Infrastructures must be built on a foundation of technical robustness, ensuring they are scalable, reliable, and interoperable to support large-scale data flows and diverse assessment models. Security, version control, and explainable AI should be prioritized to prevent the replication of black-box problems commonly found in proprietary systems. Their architecture must not only match but exceed the capabilities of traditional infrastructures, providing trustworthy, verifiable, and adaptable solutions for research assessment.

Operational Capacity

To sustain their impact, OIs require strong operational capacity, backed by governance models that ensure long-term sustainability, independence, and adaptability to evolving research policies. Usability is crucial, systems must feature intuitive interfaces, automation for efficiency, and responsive support mechanisms to facilitate adoption and build trust within the research community.

Community-Driven Practices

For OIs to remain relevant and trusted, they must be community-driven, governed by and for the research community. This ensures they remain accountable, transparent, and adaptable to stakeholder needs. Active stakeholder engagement through open feedback mechanisms, participatory governance, and collaborative policymaking is essential to maintaining their legitimacy and ensuring long-term success.

Ethical and Inclusive Foundations

Finally, OIs must be ethically grounded and inclusive, proactively mitigating biases in data, algorithms, and workflows to ensure fair representation across diverse research outputs, disciplines, and geographies. They must embrace a balanced approach, incorporating both qualitative and quantitative assessment methods, while reinforcing the idea of broader inclusiveness and participation in the benefit of OIs. This approach prevents over-reliance on simplistic and exclusionary metrics that fail to capture the full spectrum of research contributions.

Next steps

The transition to OIs is a one-way street, there is no responsible future for research assessment that relies on closed, proprietary systems. However, this shift must be deliberate, well-supported, and strategically implemented to ensure that OIs become the foundation of a sustainable, fair, and community-led research assessment ecosystem.

This report provides the foundation for this transition, but action is needed. Institutions and funders must invest, policymakers must embed OIs in research policies, and the research community must govern them transparently.

The time to act is now.

Introduction

Open Infrastructures are pivotal in advancing reforms in research assessment, addressing critical gaps, and enabling more inclusive, equitable, and transparent evaluation systems. By moving beyond traditional metrics (e.g. rankings, publication and citation counts, journal impact factors, h-index, etc), OIs enable both qualitative and quantitative approaches, fostering a holistic view of research performance that better reflects the diversity of contributions across disciplines and contexts.

The transition to OIs requires institutions to recognize the value that OIs bring, understand their capabilities, and align them with the principles of RRA. However, navigating the diverse and complex landscape of open data, tools, and platforms can be challenging. Providing clear guidance and expertise is essential to help stakeholders fully grasp the potential of OIs and how they can effectively support institutional goals and global research priorities.

This document outlines a comprehensive framework, benefits and actionable principles for leveraging OIs to advance RRA. It provides guidance to research institutions, funders, policymakers, and infrastructure providers, enabling a confident transition to OIs for transparent, fair, and innovative assessments. By detailing practices and pathways for adoption, it equips stakeholders with the knowledge and resources needed to align with Open Science priorities and promote responsible, inclusive research evaluation.

The Role of Open Infrastructures in Transforming Research Assessment

Open Infrastructures are transforming research assessment by broadening its scope, enabling institutions to adopt more inclusive, fair approaches, and balancing qualitative insights with data-driven indicators. Their key contributions to advancing research evaluation practices are mainly to:

Expand Research Assessment beyond Publications

Traditionally, research assessment systems often focus narrowly on publications, particularly high-impact journal articles, as the primary measure of success. However, this approach overlooks the breadth and diversity of research outputs, practices, and contributions, such as datasets, software, public engagement activities, and policy contributions. OIs enable a more transparent research assessment process, allowing stakeholders to examine the methodologies and reproduce results where needed. By supporting the collection, curation, and evaluation of diverse outputs, OIs expand the scope of assessment to reflect the full range of scholarly contributions. Moreover, these infrastructures feed assessment processes with evidence-based context, enriching researcher-provided narratives and ensuring that qualitative information is backed by reliable data.

Integrate Qualitative Reforms with Data-Driven Indicators

A significant strength of OIs lies in their ability to integrate qualitative assessment reforms with robust, data-driven indicators. Responsible research assessment requires a balance

between narratives that contextualize the impact and quality of research and evidence-based data that provide insights into trends, reach, and influence. By linking qualitative narratives with verifiable, transparent data, OIs enhance credibility and foster a nuanced understanding of research contributions.

Enhancing Standards and Promoting Responsible Research Culture

Open Infrastructures also play a pivotal role in ensuring interoperability and promoting best practices within the research community. By offering transparent, inclusive and community-driven frameworks for evaluation, they foster trust among researchers and institutions. This transparency encourages stakeholders to engage with new methodologies and align with a culture of responsible and open research. Furthermore, interoperable OIs ensure consistency and comparability across diverse fields, supporting a shift toward more holistic, ethical, and inclusive research assessment practices.

Reducing Administrative Burdens through Automation

Another critical contribution of OIs is their ability to reduce the administrative burden on researchers and evaluators. By automating tasks such as data collection, metadata management, and output verification, OIs streamline workflows and minimize repetitive tasks. This automation not only enhances accuracy but also frees up valuable time, allowing researchers to focus on their core activities. Community-driven, non-commercial infrastructures are particularly well-suited for this role, as they prioritize transparency, inclusivity, and the collective needs of the research community over profit motives.

Principles for Open Infrastructures

What is an Open Infrastructure

Open Science infrastructures, as defined by UNESCO (2021), encompass shared research infrastructures, both virtual and physical, designed to support the principles and practices of open science. In the context of CoARA, the focus is on Digital Open Science Infrastructures for Data-Driven Research which refer specifically to shared digital research infrastructures, virtually, remotely or physically, accessible, designed to support data-driven science while adhering to FAIR (Findable, Accessible, Interoperable, Reusable)⁴ and CARE (Collective Benefit, Authority to Control, Responsibility, Ethics)⁵ principles. These infrastructures include services and platforms that facilitate access, collaboration, publishing, monitoring, management, analysis and “upscaling” of research, innovation and acceleration of scientific and technological maturity levels. Examples include FAIR-compliant repositories, collaborative research environments, and computational platforms that enable multidisciplinary data analysis, interoperable bibliometric and research assessment systems. Additionally, they encompass digital tools and services that provide persistent unique identifiers for scientific objects, support metadata enrichment and standardization, and ensure discoverability, interoperability, and reusability of research outputs by both humans and machines.

A defining feature of OIs is their foundation in community-building efforts. These infrastructures are typically not-for-profit and aim to guarantee permanent, unrestricted access to the public, promoting inclusivity and sustainability. Furthermore, OIs are socio-technical systems that provide global perspectives while addressing specific local cultural, regional, and technological contexts. This OI approach ensures adaptability, responds to the diverse needs of research communities, and fosters collaboration across borders and disciplines.

Principles of Open Infrastructures

The principles of OIs, as presented by key initiatives worldwide⁶, are summarized in the table below. These principles outline the dimensions critical for ensuring the openness, effectiveness, and long-term sustainability of infrastructures. Together, they provide a comprehensive framework for evaluating and advancing OIs to meet the needs of research communities responsibly and sustainably.

⁴ Wilkinson, M., Dumontier, M., Aalbersberg, I. et al. The FAIR Guiding Principles for scientific data management and stewardship. *Sci Data* 3, 160018 (2016). <https://doi.org/10.1038/sdata.2016.18>

⁵ CARE principles [CARE Principles – Global Indigenous Data Alliance](#)

⁶ [POSI The Principles of Open Scholarly Infrastructure](#), [FOREST Framework for Values-Driven Scholarly Communication](#), [The TRUST Principles for digital repositories](#), [CARE Principles for Indigenous Data Governance](#), [Scoping the Open Science Infrastructure Landscape in Europe](#), [Barcelona Declaration](#), [UNESCO Recommendation on Open Science](#), [ROSiE](#) and [SRIA EOSC](#).

Table 1. Mapping of Key Principles Across Open Science Frameworks and Initiatives.

	TRUST	FOREST	POSI	EU OS Infra landscape	Barcelona DORI	UNESCO Recommend ation	ROSiE	SRIA EOSC
Community Governance	x	x	x	x	x	x	x	x
Transparency	x	x	x	x	x	x	x	x
Openness		x	x	x	x	x	x	x
Sustainability	x	x	x	x	x	x		x
Inclusion	x	x	x		x	x	x	x
FAIR Data	x	x		x	x	x	x	x
Equity		x				x	x	x
Responsibility	x	x				x	x	x
Diversity		x			x	x	x	x
Innovation						x	x	x
Adaptability			x	x		x		

The dimensions include **Community Governance, Transparency, Openness, Sustainability, Inclusion, FAIR Data, Equity, Responsibility, Diversity, Innovation and Adaptability**

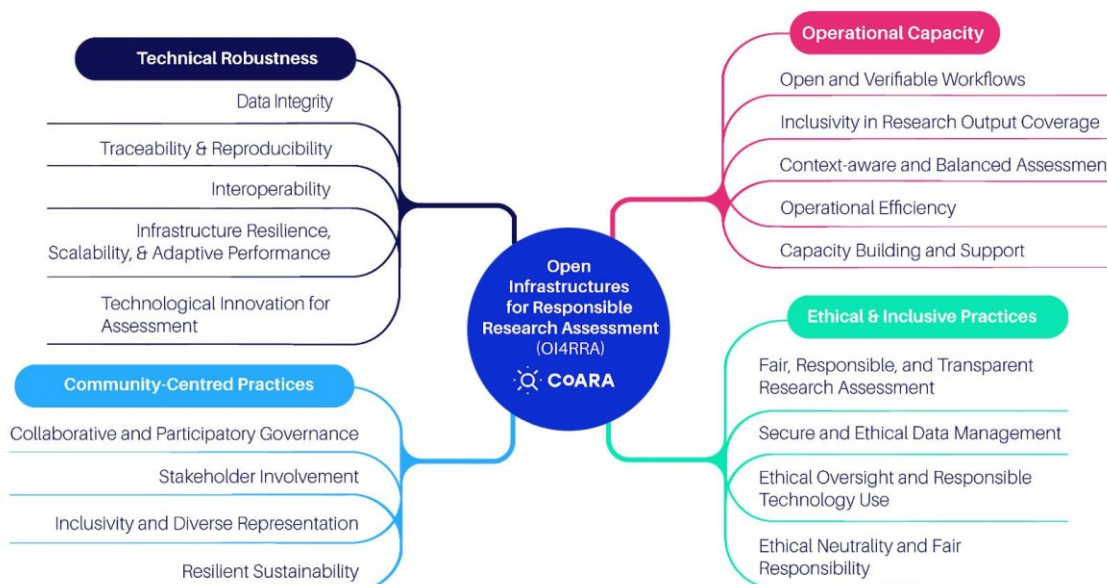
1. **Community Governance:** Stakeholder-driven models reflecting scholarly diversity, ensuring inclusive, representative, and responsible decision-making.
2. **Transparency:** Clear communication of policies, governance, and operations, alongside open access and re-use of scholarly outputs to build trust and accountability.
3. **FAIR Data:** Research data adheres to the FAIR principles.
4. **Inclusion:** proactively mitigating biases in data, algorithms, and workflows to ensure fair representation across diverse research outputs, disciplines, and geographies.
5. **Openness:** Access to data, metadata, operational processes, and software. Accompanied by open standards, protocols, and open-source software, ensuring interoperability and reusability under open licenses.
6. **Sustainability:** Long-term financial models with diverse funding, mitigating risks, ensuring independence and sovereignty from commercial entities, and maintaining equitable participation and benefits.
7. **Responsibility, Integrity, and Accountability:** Safeguarding the authenticity and reliability of scholarly outputs while ensuring accessible and trustworthy infrastructures.
8. **Diversity:** Diverse academic, indigenous, and local communities, fostering inclusion and participation across regions and social actors.
9. **Equity:** Universal accessibility and usability of OIs and scholarly outputs, adhering to metadata standards and advocating equitable participation.
10. **Innovation:** Reflection to technological and social changes, aligning with community values to enhance scholarly communication.
11. **Adaptability:** Responsiveness to evolving research needs, enabling systems to progress alongside emerging technologies, research practices, and policy requirements, such as by developing flexible tools and workflows that meet the specific demands of institutions, regions, and disciplines while ensuring inclusivity and equity.

Open Infrastructures Fit for Responsible Research Assessment (OI4RRA)

Building on the foundational principles of OIs, it is essential to define and refine the specific characteristics required for these systems to play a transformative role in enabling responsible, transparent, and equitable research assessment. Such refinements not only support the transition to fairer research assessment practices but also foster trust and accountability within the research community. To meet the diverse needs of stakeholders, OIs must integrate ethical, sustainable, and adaptable practices. These characteristics are grouped into four key categories, **Technical Robustness**, **Operational Capacity**,

Community-Driven Practices, and **Ethical and Inclusive Foundations**, summarised in the following figure.

Figure 1: A visual summary of the four key categories that define OI4RRA.



Technical Robustness

Technical Robustness (TR) for OI4RRA focuses specifically on how OIs manage, process, and utilize data to ensure transparency, fairness, and accountability in research evaluations. This involves addressing the unique requirements of research assessment processes, such as the diverse nature of research outputs, the need for traceable data, and the integration of both qualitative and quantitative information.

TR1. Data Integrity

Ensuring high-quality and reliable data is fundamental to credible, transparent, and equitable research assessments. Data must be accurate, consistent, and representative of diverse scientific contributions, allowing for fair and trustworthy evaluations.

Key Characteristics

- **Ensure Accuracy, Consistency, and Coverage** - Implement systems with the goal of continuously improving the capability to provide precise, up-to-date, and uniform data across all sources, ensuring inclusivity of research contributions from diverse regions, disciplines, and contexts.
- **Implement Validation Mechanisms** - Use automated and manual checks to verify data quality, reducing duplication, inconsistencies, and errors in reporting.
- **Guarantee Data Reliability and Trustworthiness** - Establish robust data management practices to prevent corruption, maintain authenticity, and ensure long-term accessibility for research assessments.

Why it matters: High-quality, reliable, and globally inclusive data forms the foundation of credible and equitable research assessments. Poor data quality, inconsistencies, or lack of international representation compromise fairness and erode stakeholder trust. Validated, accurate, and inclusive data strengthens confidence in the system, enabling fair, transparent, and trustworthy evaluations across diverse research communities.

TR2. Traceability and Reproducibility

A technically robust infrastructure for traceability and reproducibility ensures that data, processes, and research assessments can be independently verified, replicated, and transparently audited.

Key Characteristics

- **Data Lineage and Processing History** – Implement metadata-driven tracking systems to document the complete lifecycle of data, from collection to final use in research assessment.
- **Version Control for Transparency** – Establish versioning mechanisms for datasets, algorithms, and methodologies to support rollback, reproducibility, and long-term reliability.
- **Audit Trails and Verifiable Workflows** – Integrate logging and monitoring tools that provide an immutable record of data handling and decision-making.

Why this matters: A structured and transparent technical infrastructure ensures credibility, prevents opacity, and fosters trust in research assessments. By implementing systematic tracking, auditability, and version control, stakeholders can replicate findings, verify processes, and confidently rely on research evaluation outcomes.

TR3. Interoperability

Seamless connectivity ensures that OIs can integrate with other systems, platforms, and tools. This facilitates seamless data flow, fosters collaboration, and minimizes redundancies across the research ecosystem.

Key Characteristics

- **Open Standards** – Adopt widely recognized open standards (e.g., metadata schemas, persistent identifiers) to ensure compatibility with both current and emerging systems.
- **Persistent Identifiers** – Use globally recognized identifiers such as ORCID IDs, and ROR IDs to link research outputs, contributors, and institutions precisely and reliably.
- **APIs and Protocols** – Provide well-documented APIs and standardized protocols to enable seamless integration with other tools, platforms, and infrastructures.

Why this matters: Interoperability prevents the formation of isolated silos that hinder data sharing and collaboration. By ensuring seamless connectivity, OIs remain adaptable, efficient, and aligned with global research efforts, driving collective progress in the scientific community. Furthermore, interoperability encompasses two key aspects: **Technological Interoperability**, which enables systems to connect and exchange data through common protocols, standards, and data formats (dealing with the structure of data

exchange); and **Semantic Interoperability**, which ensures that the meaning and context of the exchanged data are preserved and understood by all systems through the use of standardized vocabularies and metadata (addressing the meaning and context of the data).

TR4. Infrastructure Resilience, Scalability, and Adaptive Performance

A resilient and scalable OI provides continuous availability, efficient performance under varying demands, and adaptability to evolving research needs. Reliability ensures that research workflows remain uninterrupted, while scalability enables infrastructures to accommodate fluctuations in data volume and user activity. Adaptability allows these systems to evolve alongside emerging technologies, research practices, and policy requirements.

Key Characteristics

- **Fault Tolerance & Redundancy** - Implement failover mechanisms, backup systems, and distributed frameworks to prevent downtime and maintain uninterrupted service.
- **Real-Time & Proactively Manage Performance** - Track system performance continuously to detect anomalies early, minimize disruptions, and ensure operational stability.
- **Elastic Scalability to Meet Demand** - Dynamically allocate resources to handle peak periods, such as grant evaluations and institutional assessments, without bottlenecks.
- **Performance Optimisation & Workflow Adaptation** - Manage resources efficiently to sustain performance across diverse workloads, supporting both routine and high-intensity operations.
- **Future Needs Anticipation & Flexibility** - Support emerging data types, interdisciplinary research metrics, and Open Science practices to ensure long-term sustainability.

Why this matters: Without scalability and resilience, OIs risk disrupting critical research and assessment workflows during high-demand periods. Reliable and adaptive systems foster trust, support innovation, and ensure efficiency, aligning with the evolving global research landscape.

TR5. Technological Innovation for Assessment

Technology-driven innovation harnesses advanced technologies like AI, including Machine Learning/Natural Language Processing (NLP), to analyse data, support qualitative and data-driven assessments, and provide actionable insights.

Key Characteristics

- **Open/Explainable Artificial Intelligence (XAI)** - Enable the analysis of vast datasets to identify patterns, automate repetitive or complex analyses, and deliver actionable insights. This is achieved by leveraging AI approaches that are open (utilizing open-source tools and/or transparent algorithms) and explainable (capable of providing understandable rationales for decisions) These capabilities improve the efficiency, depth, and precision of research assessments.

- **Open NLP** – Enhance qualitative evaluations by analysing narratives found in grant proposals, peer reviews, or impact statements using NLP tools that are openly available (open-source or developed with transparent methodologies). These tools provide nuanced insights into research quality and context, complementing quantitative metrics.

Why it Matters: Without advanced and transparent technologies, OIs may struggle to meet the complexities of modern research assessment, limiting their ability to deliver timely and actionable insights. However, as traditional black-box metrics have been rightfully challenged, it is equally important to critically assess the role of AI and NLP in research assessment contexts. In this regard, **XAI** and **auditable AI** refer to established methodologies and standards that ensure algorithmic processes are transparent, interpretable, and subject to independent review. The responsible adoption of **explainable and auditable AI** ensures that OIs remain adaptive, accountable, and effective while avoiding the pitfalls of opaque algorithmic decision-making.

Operational Capacity

Operational Capacity (OC) for OI4RRA focuses on how the infrastructure supports end-users, processes, and workflows in practical, day-to-day implementation. It emphasizes usability, efficiency, and alignment with stakeholder needs.

OC1. Open and Verifiable Workflows

An open and verifiable workflow provides transparency, explainability, and accountability in research assessment by ensuring that every stage of data processing and decision-making is accessible, understandable, and subject to scrutiny.

Key Characteristics

- **Document All Stages of the Assessment Process** – Ensure clear documentation of data collection, cleaning, processing, and analysis, making the entire workflow traceable and reproducible.
- **Ensure Explainability in Algorithmic Decisions** – Provide structured insights into how algorithms influence outcomes, detailing input variables, weighting factors, and decision logic.
- **Facilitate Independent Audits and Stakeholder Engagement** – Allow third-party verification of workflows through transparent logging, public reporting, and stakeholder feedback mechanisms.

Why this matters: Without transparency, stakeholders may mistrust assessment outcomes, questioning their fairness and reliability. Clear documentation, algorithmic transparency, and auditability ensure accountability and help users feel confident in the system's integrity.

OC2. Inclusivity in Research Output Coverage

Recognizing diverse contributions ensures that research assessments value diverse outputs, including non-traditional contributions such as datasets, software, and community engagement activities, alongside traditional publications.

Key Characteristics

- **Inclusivity of Outputs** – Encompasses datasets, software, policy contributions, patents, and teaching activities, ensuring a comprehensive view of research outputs.
- **Recognition of Non-Traditional Contributions** – Values activities such as mentoring, science communication, community engagement, and interdisciplinary collaborations.
- **Diverse Research Practices** – Accommodates unique contributions from various disciplines, career stages, and geographic regions, fostering diversity.

Why this matters: Traditional metrics often neglect valuable contributions like community engagement, mentorship, or interdisciplinary work, resulting in incomplete and biased evaluations. Recognizing diverse contributions ensures a holistic and equitable assessment of research impact.

OC3. Context-aware and Balanced Assessment

A user-centric and context-aware assessment framework ensures that OIs are adaptable to diverse institutional, disciplinary, and regional needs while maintaining a balance between quantitative metrics and qualitative narratives.

Key Characteristics

- **Customization and Local Adaptation** – Allow institutions to modify dashboards, workflows, and indicators to align with their specific goals.
- **Diverse Use Cases and Assessment Scenarios** – Accommodate different research profiles, including early-career researchers, interdisciplinary work, and collaborative projects, ensuring inclusivity.
- **Qualitative and Quantitative Evidence** – Combine narrative-based insights with metrics-based indicators to provide well-rounded evaluations.
- **Comprehensive and Flexible Frameworks** – Develop tools that recognize non-traditional research contributions (e.g., mentoring, open science practices) while ensuring fair comparisons across different contexts.

Why this matters: A rigid, metric-heavy approach risks oversimplifying research impact, while an over-reliance on narratives may lack comparability. By balancing adaptability with robust assessment methods, OIs foster trust, inclusivity, and meaningful evaluations, ensuring that research assessments are both context-sensitive and methodologically sound.

OC4. Operational Efficiency

A well-designed OI optimizes workflows, automates repetitive tasks, and ensures user-friendly interactions, enabling stakeholders to work efficiently and effectively.

Key Characteristics

- **Streamlined Workflows** – Eliminate redundancies and optimize processes for data collection, integration, processing, and reporting, ensuring faster operations with reduced friction.
- **Automation** – Automate repetitive tasks, such as data integration and cleaning, enabling users to focus on strategic activities like analysis and decision-making.

- **User-Friendly Interfaces** – Design intuitive dashboards and tools that simplify data access and usability, catering to users with varying technical expertise.

Why this matters: Inefficient workflows and complex interfaces waste time, create resource bottlenecks, and frustrate users. A streamlined and accessible system maximizes efficiency and allows stakeholders to concentrate on high-value activities like interpretation and strategic planning.

OC5. Capacity Building and Support

A well-supported OI ensures that stakeholders have the tools, knowledge, skills, and confidence to engage effectively, maximizing its impact.

Key Characteristics

- **Training Programmes** – Offer workshops, tutorials, and webinars for researchers, administrators, and policymakers, covering both system functionalities and best practices in data interpretation. Institutions must proactively offer continuous training initiatives to ensure every user remains adept and empowered in navigating and leveraging the system.
- **Support Networks** – Provide dedicated helpdesks, active user communities, and responsive technical teams to assist users and enhance their experience.
- **Skill Development** – Strengthen both technical (e.g., data analysis, visualization) and contextual (e.g., responsible metric interpretation) skills to ensure meaningful engagement with the infrastructure.

Why this matters: Without proper training and support, users may face difficulties navigating and utilizing the system, leading to inefficiencies and reduced impact. Continuous capacity-building fosters confidence, ensuring optimal use of the infrastructure and sustained adoption over time.

Community-Centred Practices

Community-Centred (CC) Practices emphasize the collaborative, participatory, and inclusive nature of OI4RRA. These principles ensure that OIs align with the diverse needs of the research community, foster shared ownership, and enable meaningful engagement. By focusing on participation, inclusivity, and sustainability, community-centred principles empower stakeholders to shape and govern OIs in a way that reflects their values and priorities.

CC1. Collaborative and Participatory Governance

An inclusive governance ensures that OIs are guided by diverse stakeholder perspectives, fostering transparency, accountability, and trust while aligning priorities with the needs of the research community.

Key Characteristics

- **Inclusive Decision-Making** – Actively involve a broad range of stakeholders – researchers, administrators, funders, and policymakers – in governance to reflect varied perspectives and priorities in decision-making.

- **Transparent Policies** – Clearly document and share governance decisions, policies, and processes to build accountability and trust in the system’s leadership.
- **Community Oversight** – Establish governance boards or advisory committees with community representatives to guide strategy and oversee priorities, ensuring alignment with the broader research community’s goals.

Why this matters: Without participatory governance, OIs risk being dominated by narrow interests, undermining their relevance and trustworthiness. Collaborative leadership ensures decisions are equitable and inclusive, and reflect the diverse values of all stakeholders.

CC2. Stakeholder Involvement

Community-driven design ensures that OIs are shaped collaboratively with their users, fostering shared ownership, increasing adoption, and aligning the infrastructure with the evolving needs of the research community.

Key Characteristics

- **Co-Creation Processes** – Actively involve stakeholders in shaping the infrastructure by defining features, setting strategic priorities, and contributing to its development. This collaborative approach fosters ownership and ensures alignment with user needs and expectations.
- **Feedback Mechanisms** – Establish regular channels and open forums, to gather stakeholder input. These mechanisms enable users to highlight areas for improvement and guide the infrastructure's evolution.
- **Outreach and Awareness** – Conduct educational campaigns, workshops, and community events to raise awareness about the infrastructure’s purpose, features, and benefits. Effective outreach drives broader participation and enhances the impact of the infrastructure.

Why this matters: Without active stakeholder engagement, OIs risk becoming disconnected from user needs, reducing their adoption and long-term relevance. Meaningfully engaging stakeholders builds trust, broadens participation, and fosters a shared sense of responsibility for the infrastructure’s success.

CC3. Equity, Accessibility, and Diverse Representation

Open Infrastructures must embrace diversity, support multilingual and multicultural participation, and ensure accessibility to create fair and representative research assessments. Diverse research practices could also include language diversity (as opposed to the dominance of English). Besides from career stages, it's also key to consider societal actors involved in research (namely, citizen science projects). By actively engaging underrepresented communities and adapting to different regional and disciplinary contexts, OIs can foster a truly inclusive and globally relevant assessment ecosystem.

Key Characteristics

- **Diverse Participation** – Actively include **underrepresented groups**, such as researchers from the Global South, Indigenous communities, early-career scholars,

researchers with disabilities, and non-English-speaking communities, ensuring broad and equitable representation.

- **Multilingual and Multicultural Support** – Provide support for multiple languages, cultural norms, and assessment practices, ensuring accessibility for users across regions and backgrounds.
- **Contextual Adaptability** – Develop flexible tools and workflows that address the specific needs of institutions, regions, and disciplines while maintaining inclusivity and equity.

Why it matters: Excluding diverse voices risks marginalizing critical perspectives, reducing the system's global relevance and credibility. Equity and accessibility enhance the infrastructure's fairness, adaptability, and ability to address the global diversity of research practices and contributions effectively.

CC4. Resilient Sustainability

Open Infrastructures must be financially stable, strategically adaptable, and operationally independent to support long-term research assessment needs. By securing diverse funding sources, anticipating future challenges, and maintaining autonomy from large commercial interests, governmental and other interests, OIs can ensure reliability, trust, and long-term impact.

Key Characteristics

- **Robust & Diverse Funding Models** – Secure diverse revenue streams, including consortia memberships, public grants, and institutional contributions, to guarantee financial stability and reduce dependence on a single source.
- **Long-Term Planning** – Develop strategic plans that anticipate future challenges, such as growing user bases, evolving technologies, and changing policy landscapes, to ensure ongoing relevance and responsiveness.
- **Independent Operations** – Avoid over-reliance on commercial entities or external pressures, ensuring alignment with the research community's values and priorities.

Why it matters: Without financial and operational sustainability, OIs risk instability, diminished credibility, and loss of trust. A resilient and independent infrastructure guarantees consistent service, adaptability to emerging needs, and long-term alignment with research community goals, ensuring lasting impact.

Ethical and Inclusive Practices

Ethical and Inclusive (EI) foundations underpin the fairness, inclusivity, integrity and accountability of OI4RRA. They ensure that the design, operation, and governance of OIs align with the values of equity, transparency, and respect for individual and institutional rights. Ethical principles are essential for building trust among stakeholders and fostering confidence in the outcomes of research assessment.

EI1. Fair, Responsible, and Transparent Research Assessment

A responsible and transparent research assessment framework ensures that metrics, workflows, and evaluation processes are open, contextualized, and verifiable. Transparent

documentation and ethical verification mechanisms foster trust, reproducibility, and stakeholder confidence in assessment outcomes.

Key Characteristics

- **Transparency in Metrics** – Clearly document methodologies, data sources, and assumptions behind metrics to ensure openness, interpretability, and responsible use within OIs.
- **Contextualized and Nuanced Evaluations** – Avoid oversimplified and rigid indicators by incorporating qualitative insights, diverse contributions, and Open Science principles into assessment frameworks.
- **Version Control for Traceability and Accountability** – Track and make accessible all changes to datasets, algorithms, and methodologies to enable **stakeholder verification and auditability**.
- **Verification and Ethical Compliance Mechanisms** – Support independent audits, community-driven validation, and open governance to align with best practices in Open Research Infrastructures and RRA.

Why this matters: Without clear documentation, contextualized assessment approaches, and independent verification, research assessments risk being opaque, biased, and unaccountable. A well-documented, reproducible, and ethically grounded evaluation system ensures that research contributions are fairly assessed, stakeholders are informed, and OIs remain trustworthy alternatives to proprietary evaluation systems.

EI2. Secure and Ethical Data Management

A responsible approach to data privacy and security ensures that OIs handle sensitive information ethically and in compliance with legal frameworks. By implementing strong governance, privacy safeguards, and controlled access, OIs can protect data integrity, prevent misuse, and foster trust among stakeholders.

Key Characteristics

- **Compliance with Regulations** – Adhere to relevant legal frameworks (e.g., GDPR) to process personal data securely, minimizing legal and reputational risks.
- **Identity protection through Anonymization and Aggregation** – Apply anonymization and data aggregation techniques to enable meaningful insights while safeguarding individual privacy.
- **Role-Based Access and Security Controls** – Restrict access to sensitive data to authorized personnel, ensuring confidentiality, accountability, and prevention of misuse.

Why this matters: Without robust privacy protections, breaches can harm individuals and institutions, undermining trust and exposing OIs to significant risks. Strong data security measures ensure ethical data handling, protect system integrity, and maintain stakeholder confidence.

EI3. Ethical Oversight and Responsible Technology Use

Open Infrastructures must operate transparently, integrate stakeholder input, and implement technology responsibly to ensure fairness and trust in research assessments.

Ethical governance, stakeholder engagement, and human oversight in AI-driven processes are essential to maintaining accountability and minimizing unintended biases.

Key Characteristics

- **Transparent and Explainable Decision-Making** – Avoid black-box algorithms by providing clear documentation of technological processes, ensuring stakeholders understand assessment criteria and decision logic.
- **Ethical Audits and Bias Mitigation Reviews** – Regularly evaluate assessment frameworks, algorithms, and decision outcomes to detect and correct biases that may disadvantage specific groups, disciplines, or regions.
- **Stakeholder Feedback and Redress Mechanisms** – Establish open feedback loops, reporting systems, and appeals processes to ensure responsiveness to community needs and maintain fairness in assessments.
- **Human Oversight in AI-Driven Decisions** – Use human-in-the-loop mechanisms to incorporate context and ethical considerations, ensuring that automated processes align with responsible assessment principles.

Why this matters: Without accountability, transparency, and ethical oversight, research assessment infrastructures risk perpetuating biases, reducing trust, and undermining fairness. A responsible and well-governed system ensures equity, stakeholder confidence, and legitimacy, fostering a trustworthy and ethically sound research evaluation environment.

EI4. Ethical Neutrality and Fair Responsibility

Ethical and Impartial Operation ensures that OIs operate fairly and responsibly, promoting unbiased research assessments free from conflicts of interest.

Key Characteristics

- **Impartiality in Operations** – Ensure impartiality in operations by safeguarding frameworks, algorithms, and decision-making processes from undue influence.
- **Promotion of Fair Practices** – Promote fair practices by recognizing diverse contributions across disciplines, career stages, and regions, while addressing potential biases.
- **Accountability and Ethical Oversight** – Establish accountability and ethical oversight through clear structures, regular reviews, and independent audits.

Why this matters: Without impartiality, assessments risk being skewed by conflicts of interest or external pressures, undermining trust and credibility. Fair and ethical operations strengthen stakeholder confidence, ensuring that research contributions are evaluated equitably and transparently.

No More Half-Measures: Build the Open Infrastructure that Responsible Research Assessment Deserves

Closed, proprietary platforms **promise streamlined assessment—but the convenience they offer can come at the expense of equity, transparency, and sovereignty**. If we want evaluation systems that honour the full breadth contributions and work for every community, we should transition from black boxes to open, public-good infrastructures. Anything less keeps us on a treadmill of incremental reforms while the fundamentals stay broken.

Five Urgent Moves

1. **Flip the funding switch**

Treat Open Science Infrastructures like electricity and water: budgeted, guaranteed, and non-negotiable. In the digital realm, they have become critical infrastructures. Embed multi-year financing for their upkeep and growth in every institutional and funder ledger.

2. **Legislate openness into the rules**

Hard-wire OIs clauses into national and international assessment policies so that compliance can never be met through opaque services.

3. **Put the whole community on the steering wheel**

Reserve seats for early-career researchers, Global South scholars, libraries, citizen scientists, and societal partners in every governance body.

4. **Supercharge literacy**

Launch permanent, funded training programmes so that narrative CVs, context-aware indicators, and machine-verifiable provenance become the *default*, not the exotic exception.

5. **Make transparency routine, not exceptional**

Require independent audits, public dashboards, and open metrics registries as standard operating practice—turning “show your working” from a slogan into an enforceable norm.

Why the Clock Is Ticking

- **Market concentration is accelerating.** Each year we delay, more research data and analytics lock behind commercial paywalls, shrinking academic agency.
- **Policy windows are open now.** CoARA, national open-science strategies, and funder mandates already point toward richer evidence and qualitative assessment—capabilities that closed systems can’t deliver.
- **Transition tools already exist.** Roadmaps, readiness checklists, and registries of compliant services are on the table; what’s missing is institutional will.

The Commitment We Owe Ourselves

Responsible research assessment will not emerge from goodwill alone; it demands infrastructure built for the purpose and **owned by the community** it serves. The framework you have just read is not a wish list; **it is a baseline**.

The moment to act is not “someday.” It is **today**. Let’s fund, mandate, and co-create the open ecosystems that make fair, global, and context-rich evaluation possible, and refuse to settle for anything less.

Coming Soon: OI4RRA Readiness Checklist

To make this framework immediately actionable, the OI4RRA Working Group will shortly publish a concise checklist. Drawn directly from this framework, the checklist translates its criteria, qualities, and elements into a clear yes/no tool. Research Performing and Research Funding organisations, consortia, and infrastructure providers can use it to confirm whether a system they plan to adopt qualifies as an Open Infrastructure for Responsible Research Assessment. By stepping through each item, decision-makers will see at a glance where a candidate service meets, or falls short of, the OI4RRA baseline and what remediation steps are required before adoption.

Annex

Methodology

The principles of OIs and infrastructures fit for RRA, as presented in this document, have been transformed into actionable guidelines. These principles, detailed in the first part of the document, are designed to provide guidance for research institutions, funders, policymakers, and infrastructure providers. They empower stakeholders to transition to OIs that promote transparency, fairness and inclusivity in research assessment.

To arrive at these actionable principles, we employed a systematic and iterative methodology. This began with comprehensive desk research to synthesize existing frameworks and literature. For OIs we adapted maturity dimensions from the work of Corcho, O., Ekaputra, F.J., Heibi, I., et al. (2024)⁷, developing a table (see Table 1) to ensure methodological transparency and facilitating the subsequent analysis. For infrastructures for RRA, the methodology involved a synthesis of key foundational frameworks⁸. This step ensured a robust understanding of the guiding principles and key practices in RRA.

In both cases, the desk research findings were enriched and validated through collaborative discussions and brainstorming sessions with working group members. These sessions brought together diverse perspectives, blending theoretical insights with practical expertise to refine and expand the identified principles and characteristics. This two-step approach: combining desk research with collaborative brainstorming—ensured a well-rounded understanding of the diverse aspects influencing research assessment today, allowing us to unveil the specific characteristics.

Following this methodological process, we adapted the principles and characteristics of OIs for RRA into actionable principles, as seen in the first part of the document. These actionable principles, as stated, are designed to offer guidance to relevant stakeholders empowering them to transition to OIs for transparent, fair, and inclusive research assessment. For further reference, the principles developed through this initial process are detailed in the annex below.

A formative evaluation of the framework and principles document was conducted through a public consultation process with the aim of gathering community feedback to make the document stronger, more relevant, and better suited to the community's needs. The document was published on Zenodo, ensuring accessibility to a broad audience. An evaluation form was developed that included both Likert scale questions and open-text

⁷ Corcho, O., Ekaputra, F.J., Heibi, I. et al. A maturity model for catalogues of semantic artefacts. *Sci Data* 11, 479 (2024). <https://doi.org/10.1038/s41597-024-03185-4>

⁸ [The Leiden Manifesto \(2015\)](#), [The Metric Tide \(2015\)](#), [ARRA \(2022\)](#), [DORA \(2024\)](#) and a critical review of relevant scholarly literature (e.g., [Skinner & Lippincott \(2020\)](#), [Di Donato \(2024\)](#)).

sections, allowing participants to provide structured ratings as well as detailed comments on the clarity, relevance, and overall quality of the proposed principles.

Additionally, two webinars were organized to further engage stakeholders. During these sessions, the document was presented and its key ideas were explained. A Mentimeter survey was used to collect live feedback, which stimulated interactive discussions among participants. This multi-method approach provided diverse perspectives and actionable insights that contributed to refining the document.