Towards a Decolonial and Policy-Aligned Framework for Open Science and Open Educational Resources in Africa

Ensuring (FAIR) Data and Educational Materials for the Future

Authorship

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Background: A Fragile Knowledge Ecosystem

2%

Africa generates only 2% of global research output, yet over 60% of it remains locked behind paywalls and institutional silos, invisible to those who need it most.

Paywalls & Silos

Knowledge trapped behind barriers

Infrastructure Gaps

30% of SADC universities lack reliable high-speed internet

Policy Fragmentation

Absence of cohesive Open Science legislation

Data Colonialism

African data stored on foreign servers

Introduction: Opinion Breakdown

Definition of terms

DE colonialism & Policy-Alignment

- *Shifting perspective by citing alternative knowledge, identities, and ways of being*
- *Different policies and strategies working together to achieve a common goal*

Open Science (OS)

- *Making scientific research and its outputs more transparent & accessible to everyone*
- *sharing publications, data, code, and methods to foster collaboration, reproducibility, etc of the scientific process*

Open Educational Resources (OER)

- *Teaching, learning, and research materials available in various formats,*
- *either in the public domain or licensed to be freely used by the end-user.*

4

F.A.I.R Principles

They make data:

- ***Findable**: Data have persistent identifiers with rich metadata so they can be discovered,*
- ***Accessible**: Data are retrievable using a standard, open, and well-documented protocol, with clear access conditions,*
- ***Interoperable**: Data use shared descriptors, standard formats, & clear identifiers to aid integration with other data*
- ***Reusable**: Data are richly described with accurate provenance and usage licenses, enabling replication, combination with other data, and reuse in the future*

The F.A.I.R-ification Process

- *Open Science Practices remove barriers to sharing research outputs, methods, and tools at all stages*
- *Enhancing transparency, reproducibility, and credibility of scientific claims*
- *Through the adoption of **FAIR principles**, open access repositories and associated resources:*

*software, instruments, and samples. Persistent Identifiers (PIDs) & rich metadata are essential **F.A.I.R-ification Claims and Evidence***

Claim 1: Infrastructure & Funding

- *Infrastructure and funding are major barriers to OER and Open Science adoption.*

Claim 2: Harmonisation & Capacity

- *Policy harmonisation and capacity building are critical for scaling Open Science.*

Claim 3: Adoption without Adaption

- *Global North-centric models often fail to address African needs and may perpetuate inequities.*

4

Claim 4: Emerging Technologies

- *Emerging technologies offer both opportunities and risks for FAIR data and OER.*

5

Claim 5: Culturally Context and Indigenous Language

- *Culturally contextualised and indigenous language OER initiatives improve engagement and learning outcomes.*

6

Claim 6: Decolonial, Policy-aligned Frameworks

- *Decolonial, policy-aligned frameworks are essential for equitable access to Open Science and OER in Africa.*

Problem Statement

"African knowledge is trapped by historical and structural barriers, but by adopting a decolonial, policy-aligned, and FAIR framework, we can build resilient and sustainable networks that liberate it for continental development."

Claim 1: Infrastructure & Funding

Infrastructure and funding are major barriers to OER and Open Science adoption.

Claim 2: Harmonisation & Capacity

Policy harmonisation and capacity building are critical for scaling Open Science.

Claim 3: Adoption without Adaption

Global North-centric models often fail to address African needs and may perpetuate inequities.

Claim 4: Emerging Technologies

Emerging technologies offer both opportunities and risks for FAIR data and OER.

Justification

- *Open science and OER can help reduce educational disparities in African regions, but their impact is limited by persistent structural and contextual barriers.*
- *Open science improves educational equity by increasing access, participation, and inclusion, though its impact depends on addressing persistent barriers.*
- *Open educational resources (OER) increase access and support inclusion for diverse student populations, but their full potential depends on intentional design and addressing persistent barriers.*

The Resolution of Claim 5: Culturally Context & Indigenous Language

- *Culturally contextualized and indigenous language OER initiatives improve engagement and learning outcomes*

The Resolution of Claim 6: Decolonial & Policy-aligned Frameworks

- *Decolonial, policy-aligned frameworks are essential for equitable access to Open Science and OER in Africa*

Research Questions and Gaps

Practical implementation, equity, and sustainability.

- ***RQ1:*** *How can Indigenous knowledge systems be integrated into Open Science and OER in Africa while ensuring FAIR compliance, data sovereignty, and ethical collaboration with communities?*
- ***RQ2:*** *What policy mechanisms and governance structures are needed to align decolonial principles with FAIR data and OER practices in African contexts, and how can they be harmonized across regions?*
- ***RQ3:*** *How can emerging technologies (e.g., AI, blockchain) be adopted in African OS and OER to enhance FAIRness while mitigating risks related to language exclusion, bias, and digital colonialism?*
- ***RQ4:*** *What sustainable and equitable funding models can support decolonial OS and OER initiatives in Africa, ensuring long-term viability and community benefits?*
- ***RQ5:*** *How does a decolonial framework influence the findability, accessibility, interoperability, and reusability of educational materials and research data in African OER and OS ecosystems?*

Hypothesis

- ***Null Hypothesis (H0):*** *Implementing a decolonial and policy-aligned framework for Open Science and OER in Africa does not lead to a significant improvement in the FAIRness (Findability, Accessibility, Interoperability, and Reusability) of data and educational materials compared to existing approaches.*

- ***Alternative Hypothesis (H1):*** *Implementing a decolonial and policy-aligned framework for Open Science and OER in Africa leads to a significant improvement in the FAIRness of data and educational materials by:*

    - *Enhancing the integration of Indigenous knowledge while ensuring data sovereignty.*
    - *Addressing technology risks through inclusive design and language diversity.*
    - *Establishing sustainable funding models that promote equity.*
    - *Aligning policies with practical implementation for greater impact.*

Purpose Of Our Investigation

Aim

*This paper aims to **redefine** the implementation of Open Science and OER in Africa's context by proposing a **decolonial, policy-aligned framework** that priorities African sovereignty, linguistic diversity, and sustainable infrastructure.*

Investigation Objectives

***DECONSTRUCTION** of colonial legacy in African knowledge systems*

***DIAGNOSE** contemporary barriers to FAIR implementation*

***ANTICIPATE** future technological trajectories*

***SYNTHESIZE** actionable decolonial framework*

Our Investigation: Methodology

A Three-Pronged Critical Analysis

- ***Overall Approach:*** *A multi-faceted critical analysis to diagnose the past, present, and future of Open Science in Africa.*
- ***Objective:*** *To move beyond technical FAIR compliance and build a framework centered on sovereignty, equity, and policy alignment.*

Prong 1: Historical Archaeology of Open Science

- ***Approach:*** *Critical analysis of early initiatives (2005-2015)*
- ***Objective:*** *Identify foundational flaws and colonial legacies.*

- ***Data Sources:***
  - *OpenUCT (South Africa)*
  - *LISGIS Hub (Zambia)*
  - *HINARI (Ethiopia)*
  - *AJOL (Kenya)*

- ***Analytical Lens:***

Dependency theory, postcolonial critique

- ***Expected Outcome:***

Maps the evolution from "access models" to "sovereignty imperatives."

Our Investigation: Methodology

B. A Three-Pronged Critical Analysis

- ***Overall Approach:*** *A multi-faceted critical analysis to diagnose the past, present, and future of Open Science in Africa.*
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Prong 2: Contemporary Landscape Mapping

- ***Approach:*** *Multi-case study analysis (2018-2023) across technical, policy, and cultural dimensions.*
- ***Objective:*** *Identify current resilience patterns and vulnerability factors.*

- ***Data Sources:***
  - *28 case studies from Consensus database*
  - *UbuntuNet reports*
  - *National policy documents*

- ***Analytical Framework:***
  - *FAIR compliance metrics*
  - *SDG alignment*
  - *Sovereignty indicators*

- ***Expected Outcome:***

Identifies successful resilience patterns vs. persistent vulnerability factors.

Our Investigation: Methodology

B. A Three-Pronged Critical Analysis

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Prong 3: Futures and Perspectives Integration

- ***Approach:*** *Scenario analysis and multi-stakeholder perspective integration.*
- ***Objective:*** *Synthesize competing narratives into a coherent strategic framework.*

- ***Data Sources:***
  - *Technology forecasts*
  - *Policy documents*
  - *Grassroots innovation cases*

- ***Analytical Methods:***
  - *SWOT Analysis*
  - *Stakeholder Mapping*
  - *Policy Gap Analysis*

- ***Expected Outcome:***

Synthesises competing narratives into a coherent strategic framework.

Results and Analysis

Key Findings: Evidence-Based Claims

- *Analysis of the historical and contemporary data reveals four critical claims for a decolonial FAIR framework.*

Investigation Outcomes

Claim 1: Infrastructure Models Determine Sovereignty Outcomes

- ***Evidence:***
  - ***Centralized models (e.g., OpenUCT):*** *Achieved scale but failed on equity.*
  - ***Decentralized models (e.g., Ethiopia's GADDS):*** *Showed resilience but face scaling challenges.*
- ***Analysis:*** *The technical architecture of knowledge systems is inherently political. Decentralization correlates with increased community ownership and sustainability.*

Claim 2: Linguistic Diversity is a Technical Requirement for FAIRness

- ***Evidence:***
  - *Malawi's multilingual OER showed* ***3x higher engagement*** *than Senegal's French-only platform.*
- ***Analysis:*** *The "I" (Interoperability) and "R" (Reusability) in FAIR are compromised when language exclusion limits who can find and use resources.*

Results and Analysis

Key Findings: Evidence-Based Claims

- *Analysis of the historical and contemporary data reveals four critical claims for a decolonial FAIR framework.*

Investigation Outcomes

Claim 3: Policy Harmonisation Precedes Technical Interoperability

- *Evidence:*
  - ***Rwanda's binding OER policy** drove a 200% increase in repository usage.*
  - ***AOSP Charter ratification** by only 5 nations reflects systemic fragmentation.*
- ***Analysis:** Without pan-African policy alignment, technical standards remain isolated and unsustainable.*

Claim 4: Sustainable Financing Requires Breaking Donor Dependency Cycles

- *Evidence:*
  - ***Zambia's LISGIS collapse** vs. **Botswana's diamond-funded repositories** demonstrate the sovereignty-finance nexus.*
- ***Analysis:** Financial models determine long-term viability more than technical specifications.*

Case Studies: Lessons from the Frontlines

Real-world implementations across the continent reveal both the transformative potential of Open Science and the persistent challenges that must be addressed to achieve true resilience.

Kenya: Health Data Repository

Success: *FAIR-compliant repository reduced data duplication by 40%, enabling more efficient research collaboration.*

Challenge: *Inconsistent metadata standards hindered cross-institutional interoperability and data discovery.*

Tanzania: Open Science Cloud

Success: *National cloud infrastructure now hosts over 10,000 research datasets, dramatically improving accessibility.*

Challenge: *Heavy reliance on foreign cloud providers raises serious concerns about data sovereignty and long-term control.*

South Africa: OpenUCT Initiative

Success: *Institutional repository archived 20,000+ research papers, setting a continental benchmark for open access.*

Challenge: *Centralised model in Cape Town inadvertently excluded rural and under-resourced institutions from full participation.*

Key Insight: *Technical success alone is insufficient. Resilience demands data sovereignty, decentralised infrastructure, and inclusive design that reaches beyond urban centres.*

Conclusion and The Strategic Framework

The Proposed Framework: A Sovereign Knowledge Commons

- ***Validated Hypothesis (H1):*** *A decolonial, policy-aligned framework significantly improves FAIRness.*

- ***How it transforms FAIR:***
  - ***Findability:*** *Community-centered metadata & multilingual tagging.*
  - ***Accessibility:*** *Resilient infrastructure for African contexts (solar-powered, low-bandwidth).*
  - ***Interoperability:*** *Standards that honor Indigenous Knowledge Systems.*
  - ***Reusability:*** *Culturally relevant, co-created resources.*

1

- ***For Policymakers:***
  - *Ratify AOSP Charter with sovereignty safeguards.*
  - *Integrate Open Science into national development plans.*
  - *Allocate 1% GDP to digital infrastructure (rural prioritisation).*

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- ***For Universities & RENs:***
  - *Adopt decentralized models (e.g., SADC Data Grid).*
  - *Implement the FAIREST framework for continuous improvement.*
  - *Develop multilingual OER through community partnerships.*

3

- ***For International Partners:***
  - *Shift from project funding to capacity investment.*
  - *Respect data sovereignty in collaborative research.*
  - *Support African-led technology development.*

Guide: Aligning with Continental Agendas

Our solution is rooted in our own development plans, not external impositions. Open Science represents the practical implementation of commitments we have already made to ourselves.

AU Agenda 2063

Aspiration 1: *A prosperous Africa, based on inclusive growth and sustainable development. Open Science provides the knowledge infrastructure for this prosperity.*

SADC RISDP 2020-2030

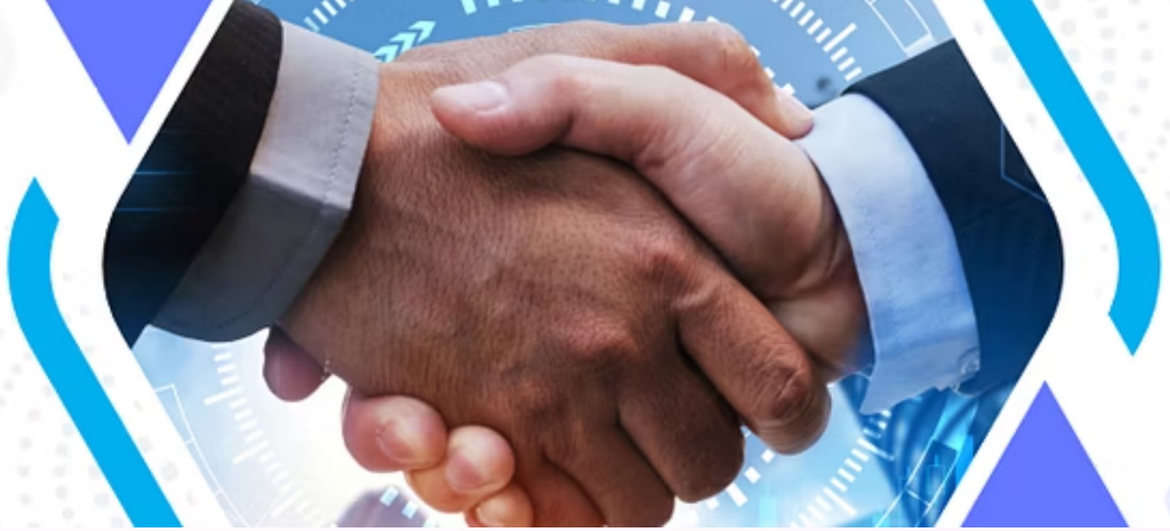
Objective 8.3: *Expand ICT infrastructure for education and research collaboration. Network resilience depends on open, accessible knowledge flows.*

Zimbabwe NDS1

National Target: *Digitalise 40% of tertiary curricula using OER by 2025. Concrete action towards educational transformation and equity.*

Thank You!

For your attention



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Let's Continue the Conversation

Together, we can build knowledge networks that are truly resilient, sovereign, and designed to serve African priorities and African futures.

"Open Science must be African Science, rooted in our languages, our challenges, and our dreams." ***—Dr. Thandeka Moyo***