OPEN SCIENCE IN AFRICA: FOR WHAT AND WHOSE MANDATE?

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Abstract

Open Science encompasses a wide range of practices that include open data, open access, open research, citizen science, among others, largely focusing on facilitating easy access to publicly funded research. In Africa, the concept is relatively new and implementing Open Science initiatives can be complicated. Open Science is good for Africa. There are several benefits to be derived by stakeholders from opening the continent's science research process and outputs to the world. But, Open Science for what? And whose mandate is it to ensure that Africa pursues and derives maximum benefits from Open Science? This paper argues that Open Science initiatives should address the challenges faced by the continent and should support national and Africa wide development agendas. Governments should put in place policy frameworks for Open Science and mandate institutions that are coordinating science, technology and innovation (STI) research to lead national Open Science initiatives. Increased public funding for STI research is key to implementing successful Open Science initiatives. Africa is home to several opportunities that could spur investments in research.

Keywords: *Open science; Africa; Agenda 2063, STISA-2024.*

Introduction

Open Science encompasses a wide range of activities and this is reflected in most definitions of the term. The Organization for Economic Co-operation and Development (OECD) refers the term as:

> "efforts by researchers, governments, research funding agencies or the scientific community itself to make the primary outputs of publicly funded research results – publications and the research data – publicly accessible in digital format with no or minimal restriction as a means for accelerating research; these efforts are in the interest of

enhancing transparency and collaboration, and fostering innovation" (OECD, 2015:7).

Open Science includes open access to scholarly publications, open data, and open and collaborative research (Mgwebi, 2016). Other activities under Open Science are open peer review, open research and stakeholder engagement or *Citizen Science*, in which non-specialists engage directly in research (European Commission, 2017a). Knack (2017:4) indicates that Open Science research process "*encourage openness, transparency and access to knowledge through research collaboration and participatory, bidirectional modes of interaction between researchers and society*".

In practical terms, Open Science is about:

- improved collaboration among stakeholders in the scientific research process and between countries to address shared challenges;
- increased understanding of and participation in science by the public (Citizen Science), thus taking "open science activities beyond the purview of professional scientists' circles" (Knack, 2017:4);
- enhanced access to research outputs such as reports, journal articles, research data, etc. on a 24/7 basis, and;
- ultimately enhanced impact of research.

Novel and innovative information and communication technologies (ICTs) have been key to Open Science. The United Nations Educational, Scientific and Cultural Organization (UNESCO) states that, "openness in obtaining, processing, publishing and disseminating research information becomes easily achievable due to spread of ICTs and ICT-enabled services" (UNESCO, 2015:3). ICTs have created new opportunities for the scientific community to publish research outputs, organize large data sets, speed up the transfer of knowledge, and involve citizens in the scientific research process.

Open Science is a new concept in Africa and implementing Open Science initiatives can be difficult and complicated. Open Science is good for Africa. However, to actively participate in the ever-growing Open Science movement and for it to have a positive impact on the livelihoods of the people, African governments should increase funding for research and development (R&D), Open Science should address the challenges facing the continent, and national and Africa-wide agencies with a mandate for R&D should lead Open Science initiatives. This paper provides some thoughts on these three issues, that are among several (e.g. building capacities of institutions and individuals, putting in place an enabling environment for Open Science, addressing researchers' concerns regarding open sharing of data, technical infrastructure, etc.) that need to be addressed for Open Science to flourish in Africa.

Public Funding for Research

Public agencies usually fund basic scientific research (Chesbrough, 2015: 8), but in Africa, in general, there is very little public funding for research and development. In addition, except for a few countries (e.g. Namibia and South Africa), there is practically no private investment in R&D (Marsh, 2016). Poor public and private funding for R&D could be one of the reasons for the low amount of research outputs from Africa that could be made accessible through initiatives such as open data and open access. Sub-Saharan Africa accounts for less than 1% of the world's research output (Blom, Lan & Adil, 2016) and 0.03 % of the world's research data (Onyancha, 2016). Not surprisingly, Sub-Saharan Africa also features badly on the Global Innovation Index (GII). The 2017 edition of the GII, focusing on the theme of innovation in agriculture and food systems, ranked the region last on the Index (Cornell University, INSEAD, & World Intellectual Property Organization [WIPO], 2017).

Africa largely relies on international partners to fund R&D. The continent needs to invest billions of dollars in science and technology to make any headway (Marsh, 2016). Governments should invest in R&D to drive the national and continental research agenda and ensure that it is responsive to the continent's development needs. There is an urgent need to accelerate investments, by both governments and partners, in developing capacities of scientists and research agencies to further increase research on solving African problems by Africans for Africans (Blom, Lan & Adil, 2016). Several high-level opportunities to spur African governments to invest in R&D are already in place.

Science, Technology and Innovation Strategy for Africa 2024
In June 2014, the Heads of State and Government of the African Union adopted the Science, Technology and Innovation Strategy for Africa 2024 (STISA-2024) "to respond to the need of transforming Africa into a Knowledge-based and Innovation-led Society" (African Union Commission, 2014: 20). The strategy focuses on six socio-economic priorities, namely:

- Eradication of hunger and achieving food security;
- Prevention and control of diseases;
- Communication (Physical & Intellectual Mobility);
- Protection of our space;
- Live together – build the society;
- Wealth creation.

STISA-2024 recognizes that Africa has the potential to fund science, technology and innovation research and strongly urges Member States to allocate at least 1% of GDP to R&D "to ensure that Africa maximizes ownership and responsibility for its own developmental path" (African Union Commission, 2014: 41).

Although, there has been an increase in public funding for R&D, only Kenya with 0.8%, and Mali and South Africa, each with 0.7%, come anywhere near the 1% target (Montoya & Chalaud, 2016). STISA-2024 also recommends setting up an African Science and Technology Innovation Fund (ASTIF) and encourages Regional Economic Communities (RECs) to establish regional funds to support research in STISA-2024 priority areas "as well as cross-border research and innovation collaboration addressing common challenges" (African Union Commission, 2014: 42).

The Agenda 2063

The *2063 Agenda: the Africa we Want* of the African Union is a strategic framework for the socio-economic transformation of the continent adopted by the Heads of State and Government of the African Union at their 24th Ordinary Assembly in Addis Ababa, Ethiopia, held from 30-31 January 2015. The Agenda recognizes the key role of STI in achieving continental development goals. It commits the Heads of State and Government to speed-up actions to "catalyze education and skills revolution and actively promote science, technology, research and innovation, to build knowledge, human capital, capabilities and skills to drive innovations and for the African century" (African Union Commission, 2015: 14).

The 2030 Agenda for Sustainable Development

The 2030 Agenda for Sustainable Development calls for mobilization of resources and collaborative partnerships to end all forms of poverty, fight inequalities and tackle climate change, while ensuring that no one is left behind, to be achieved through 17 Sustainable Development Goals (SDGs) (United Nations, 2015). Developing countries are now using the SDGs to guide their development policies and programmes. The 2030 Agenda and the SDGs also provide another opportunity for African governments to invest in STI to contribute and accelerate the attainment of the SDGs on the continent. Specifically, this is highlighted in *SDG 9: Build Resilient Infrastructure, Promote Inclusive and Sustainable Industrialization and Foster Innovation* under which Target 9.5 encourages governments, especially in developing countries, to promote sustainable industrialization and innovation by increasing public and private spending on R&D and the number of researchers for every one million inhabitants.

Open Science for What?

Open Science has several benefits. Participants at the Open Science Leadership Forum, in 2017, identified the following as possible outcomes of successfully implemented open science initiatives (Ali-Khan, Jean & McDonald, 2017):

- Increased quality and efficiency of scientific outputs;

- Accelerated innovation and impact;
- Increased trust and accountability of the research enterprise;
- Increased equity in research;
- Better opportunities and recognition of early career researchers and youth.

Further, the European Commission (2017b:5) indicates that "broader access to scientific publications and data helps to:

- build on previous research results (improved quality of results)
- encourage collaboration and avoid duplication of effort (greater efficiency)
- speed up innovation (faster progress to market means faster growth)
- involve citizens and society (improved transparency of the scientific process)".

In Africa, Open Science should not be for its own sake and a prerogative of the scientific community. Open Science initiatives should be aligned with the needs expressed by African governments. They should respond to people's real needs and address the development challenges facing the continent. This concern was well articulated by participants at the East African Open Data Fest, in 2016, who, among others, asked the question: *"Does open data have any relevance to the daily bread and butter issues that African citizens face?"* (ICT Works 2016). Indeed, Open Science (or open data or open access) for what?

Africa is facing several challenges including climate change, diminishing land and water resources, youth unemployment and migration, post-harvest losses, HIV/AIDS, population growth, inadequate infrastructure, environmental degradation, and disease outbreaks. All these require innovative solutions and Open Science should contribute to the solutions. For example, opening access to clinical and epidemiological data during disease outbreaks could potentially transform and quicken the scientific and medical community's response to outbreaks (Yozwiak, Schaffner & Sabeti, 2015).

Open Science initiatives on the continent should be aligned with national or Africa wide development agendas to ensure ownership and sustainability. They should also complement initiatives being carried out under the Open Data for Development (OD4D) programme which governments are being supported to open access to their data to enhance transparency and accountability, and to facilitate public service delivery and citizen participation (Open Data for Development Network, 2016).

One off Open Science initiatives should be avoided. African governments and development partners should guarantee long-term commitment to Open Science

and allocate resources. This, to a large extent, can be achieved by aligning Open Science initiatives to the continent's development agendas. The African Union's Agenda 2063, the Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods, the Comprehensive Africa Agriculture Development Programme (CAADP), the regional Economic Communities development plans (e.g. Southern African Development Community's Regional Indicative Strategic Development Plan) and national development plans, most of which have or are being aligned to the 2030 Agenda and SDGs, all offer huge opportunities for Open Science to make a direct impact on the lives and livelihoods of the people.

Open Science: Whose Mandate?

Open Science activities, whether at institutional, national or regional level, involve and affect a diversity of stakeholders. At the national level, these include government policy makers and their partners as research funders; researchers and scholars from different scientific domains as generators of knowledge and innovations; information and knowledge institutions (e.g. libraries, information centres, etc.) working to facilitate open access to research outputs especially research reports, research data, journal articles, etc.; ICT specialists to develop and maintain the technical infrastructure to support Open Science; and the interested public who include users of the research outputs. Therefore, multi-stakeholder approaches to Open Science should be adopted to forge a shared vision and ensure buy-in. Policy frameworks and guidelines for Open Science to help stakeholders to align their interests with the development agendas should also be put in place.

Open Science at the basic level focuses on publicly funded research, the underlying research data, and involves a diversity of stakeholders. Therefore, whose mandate should it be to ensure that it serves the needs and interest of the people and countries in Africa?

To flourish, Open Science in Africa should have support from the highest political and government levels and be driven from within Africa. For example, the European Commission backs policies that support increased public access to research and open access initiatives (Gewin, 2016). In the United States of America (USA), a Federal Government policy requires federal science agencies that spend more than USD 100 million per year in R&D to develop plans to increase public access to the results, especially peer-reviewed scientific publications and digital scientific data of federally funded research (White House Office of Science and Technology Policy [OSTP], 2013). In the United Kingdom, the government through its Innovation and Research Strategy for Growth supports, supports open access to publicly funded research (Department for Business Innovation Skills, 2011). Government support and involvement go a

long way in aligning Open Science initiatives with the country's developmental goals and in facilitating sustainability of the initiatives.

The South African Department of Science and Technology (DST) and the country's National Research Foundation (NRF) are the leading public institutions supporting Open Science on the continent. They both support and fund Open Science initiatives in South Africa and at the continental level. DST and NRF are supporting the establishment of an African Open Science Platform to promote the value and exploit the potential of Open Data for science (CODATA, 2016). African needs continental and national agencies with the mandate to supervise and coordinate STI to be involved and to lead Open Science initiatives. Their involvement, in a way, would contribute to addressing some of the concerns by African scientists, including that "open data compromises national ownership and reopens the gates for 'parachute-research (i.e., Northern researchers absconding with data to their home countries)'" (Serwadda, et. al. 2018:642).

While non-state science organizations such as the African Academy of Sciences (AAS), Academy of Science of South Africa (ASSAf), the Council for the Development of Social Science Research in Africa (CODESRIA), to name a few, are already active in the Open Science movement on the continent, most public agencies that coordinate or fund research appear to be keeping a low profile. At the Africa-wide level, the Africa Union's Commission for Human Resources, Science and Technology, that also has a mandate to promote science and technology on the continent, should be leading the way and provide an Africa-wide policy framework on Open Science. At the national level, as seen in the case of South Africa, government Ministries responsible for science and technology should be playing a key role, and should be supported by national science and technology research agencies or councils. Research agencies/councils are key institutions in bringing about changes being proposed by Open Science movements, since they sponsor and facilitate research (Lithotomies, Kretz & Sá 2015). Examples of major national research organizations and agencies funding or coordinating research in Sub-Saharan Africa, include the following:

- Ghana: Council for Scientific and Industrial Research;
- Kenya: National Council of Science and Technology (NCST), Kenya Agriculture and Livestock Research Organization (KALRO), and the National Research Fund (NRF);
- Nigeria: Agricultural Research Council of Nigeria (ARC) and the National Research Institute for Chemical Technology (NRICT);
- South Africa: Council for Scientific and Industrial Research (CSIR) and the Human Sciences Research Council (HSRC);
- Tanzania: Tanzania Commission for Science and Technology (COSTECH);

- Uganda: Ugandan National Council for Science and Technology and the National Agricultural Research Organization (NARO);
- Zambia: National Council for Scientific Research, National Institute for Scientific and Industrial Research (NISIR) and the Zambia Agricultural Research Institute (ZARI).

Strategic leadership is key to Open Science in Africa and national and continental public agencies with a mandate for STI research should take a lead role and provide policy guidance on Open Science. They should also play a key role in advocating for reward mechanisms for researchers who make their publications, research data and methodology open for scrutiny. Otherwise the "publish or perish" syndrome will continue making it difficult for Open Science on the continent to receive unequivocal support from researchers, especially from young generation of researchers who are trying to establish themselves in an environment in which recognition is based on metrics such as publication in high-impact journals.

Conclusion

Open Science provides Africa with an opportunity to enhance its visibility on the global science stage. However, Open Science initiatives should not be pursued for their own sake. They should address the many challenges besieging the continent and ultimately contribute to improving the livelihoods of millions of Africans. Several opportunities, including STISA-2024, the Global 2030 Agenda for Sustainable Development and the African Union's Agenda 2063 provide an opportunity for Africa to improve its STI sector. However, this would require increasing funding for STI research, putting in place enabling policy frameworks and strategies that support Open Science, adopting multi-stakeholder approaches, and having strategic leadership at national and Africa wide level to ensure that Open Science initiatives contribute to national and continental development agendas.

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