

Open Science in Research and Innovation for Development
Annual Forum of the Science Granting Councils Initiative (SGCI), 2019



SUMMARY OF KEY ISSUES AND RESOLUTIONS

The Science Granting Councils Initiative (SGCI) aims to strengthen the capacities of science granting councils in sub-Saharan Africa to support research and evidence-based policies that will contribute to economic and social development. The Initiative is jointly funded by United Kingdom’s Department for International development (DFID); Canada’s International Development Research Centre (IDRC); South Africa’s National Research Foundation (NRF) and the Swedish International Development Cooperation Agency (SIDA). The Initiative currently works with 15 African Countries including: Botswana, Burkina Faso, Cote d’Ivoire; Ethiopia, Ghana, Kenya, Malawi, Namibia, Mozambique, Rwanda, Senegal, Tanzania, Uganda, Zambia and Zimbabwe.

The Initiative convenes high-level Annual Forums that bring together the participating Councils with other science systems to deliberate on key topical issues of strategic importance to the Councils and national development as well as to enhance African voices on regional, continental and international policy debates.

In 2019, the theme for the Annual Forum was, “Open Science in Research and Innovation for Development.” The following are key issues and resolutions from the SGCI Annual Forum.

- The delegates observed that Open Science is not a new concept in Africa, and that some of its components are already being practiced by African researchers and institutions in areas such as open access publications. However, the emergence of ‘research as an enterprise’; the new general-purpose technologies and new priorities for development have brought new dimensions to open science approaches.
- Delegates further observed that African Science Granting Councils are already working collaboratively in bilateral and multi-lateral cooperation, sharing resources, infrastructures, skills and capacities. These collaborations promote openness and in some cases have led to peer – to – peer learning, experience and knowledge sharing and replicability.
- The delegates noted that the transition to a “knowledge society” where productivity and innovation would be hinged more on knowledge – its generation and application – and less on natural resource endowments.

- This transition is underpinned by the digital revolution as a key enabler of open science. However, the digital revolution also leads to a “Tsunami of Information” – its acquisition, storage, manipulation and potential for applications is ubiquitous.
- To be relevant and useful, the delegates noted that information needs to be released to society in a comprehensible form. This requires positive mutual engagement with society.
- Delegates also noted that development challenges are complex and characterized by emergent behavior. It is not easy to predict future outcomes based on current events hence the need for society to accept and organize to mitigate the associated risks.

WELCOME ADDRESSES

Amos Nungu, *COSTECH, Tanzania*

Eunice Muthengi, *East African Research Hub, UK Department for International Development*



Dr Amos Nungu in his welcome remarks noted that the precepts of Open Science (OS) have been documented in the masterclass that was shared by the research team, and that the SGCs should be able to facilitate the process of OS in their respective councils, as well as choose the media that is able to promote the different components of OS, i.e. open publishing, open access, open source, among others. He recognised that the Masterclass Session allows for discussion and appreciation of what it takes to adopt OS and called on all the participants to chime in, and look forward to sharing within and between the institutions present, which should be fostered more.

“Currently, we are all aspiring towards the SDGs, which modestly require the application of OS, and when we talk of ST&I for the SDGs, OS provides the solutions we are looking for. If a researcher in Kenya for instance is researching on something and a person from Uganda is not able to replicate, the Kenyan people may be able to address solutions for the developmental challenge, while we shall have to get more funds to do the same research in Uganda to solve the same kind of challenge. But if the process is open, then the solutions can be applied in Uganda, in Rwanda in South America, sharing best practices among the councils.”

In her remarks Eunice Muthengi started by checking the temperature in the room on those who understood OS (hot), those who did not fully understand what OS is about (lukewarm) and those who felt that OS is a far-fetched dream (cold), finding out that most of the room was lukewarm. Evoking the need for OS based on her own research experience, Dr Muthengi mentioned that she was glad funders are taking the decision to support OS publishing platforms. DFID recently performed a review of their OS policies, found that it was similar to that of other funders but that there was room for improvement. They are viewing their policies, and have endorsed PlanS, a coalition of 13 European funders including the UKRD and they are making the transition to adopt and open publishing model, while recognising that open access is just one of the elements of OS. Some of the questions they have been asking with regard to OS for R&I in Africa are, “Does OS increase marginalisation or does it bridge the divide? How do we ensure that OS benefits excluded groups?” These are some of the questions that they expected the Masterclass is able to address, and that the cold and lukewarm teams are able to find answers to those questions. DFID and other funders are looking into the SGCs to get the direction of travel for OS for Africa, so that they can continue to look at their policies and procedures to make sure that they are supporting the needed causes.

INTRODUCTION TO THE SESSION AND THE MASTERCLASS PAPER AUTHORS

Nicholas Ozor, *African Technology Policy Studies Network (ATPS), Kenya*

Dr Ozor recognised that the themes of the SGCI Masterclass sessions, which have happened for the last four (4) years are direct recommendations of the Science Granting Councils on topical issues that are important to them and other science system actors, so as to foster their mandate. Once a topic is selected, the commissioning team engage with experts and professionals in the field within and outside Africa to ensure that the topic gets the best team to discuss and provide information around the chosen thematic area. He then presented the authoring team of the Masterclass of the day, including Prof Geoffrey Boulton, University of Edinburgh and Joseph Mwelwa, Joint Minds Consulting, Botswana.

PRESENTATION OF MASTERCLASS PAPER: OPEN SCIENCE IN RESEARCH AND INNOVATION FOR DEVELOPMENT

Geoffrey Boulton, University of Edinburgh, Scotland

Joseph Mwelwa, Joint Minds Consulting, Botswana

THE KNOWLEDGE ECONOMY & OPEN SCIENCE

The knowledge economy was presented as the basic economic resource, quoting Peter Drucker, 1969, ““The basic economic resource – the means of production, to use economists’ terms – is no longer capital, nor land, nor labour. It is and will be – knowledge.” The knowledge economy is powered by the digital revolution which grew principally from the 1980s and provided a tsunami of information in the current age, building the information society which is characterised by applications including ubiquitous communication, the web, computation, machine learning and blockchain.

Open Science has taken a new form, “If you have an apple and I have an apple and we exchange these apples, then you and I will still each have one apple. But if you have an idea and I have an idea and we exchange these ideas, then each of us will have two ideas” (George Bernard Shaw). OS is an umbrella concept/philosophy which has underneath it concepts of Open Data, Open Access to Scientific Publications and Open to Society.

A SCIENTIFIC REVOLUTION

The scientific revolution is driven by broad data, and without open data, there is no board data. Broad data builds complex patterns in nature and society, where the whole is the sum of the parts, without planning the emergent pattern. Science 50 years ago, we were been able to simulate system dynamics and now we are able to map complex states thanks to availability of data. We can now analyse complex systems in a way that we have not been able to before. Most global challenges are embedded in “complex” systems. The other revolutionary development is machine learning where algorithms are applied e.g. when geologists involved in the predication of the North Atlantic Ocean Circulation.

The principle opportunity for modern science is complexity, while its principle challenge is sustainability. E.g. in neural applications, the relationship between the neural interface and artificial intelligence can be used in specific applications such as memory, concentration, ageing and hands free control, inverting the cognitive cycle, albeit with ethic concerns. Science and technology are racing forwards and taking economies with them, where data produces complexity and human enhance applications.

WHY DOES IT MATTER FOR AFRICA?

Open Science is a key enabler of the 4th Industrial Revolution (4IR), while we cannot reap into the benefits of the 4IR without the infrastructure that allow you to benefit from it. For instance, the success of the AfCFTA will depend on its performance in this revolution and the success in this revolution will depend upon Africa’s relevant S&T base, hence the debate on whether the applying the 3rd Industrial Revolution (3IR) is much easier than the 4IR.

However, all technologies have a dark side, however, we can mitigate the risks by understanding where the dark comes from, often in the form of spreading lies, political manipulation, invasion of privacy, cyber-crime, cyber-welfare, displacement of humans, and existential risks. Society must equip itself with the skills to avert these risks.

THE OPEN SCIENCE TOOLKIT

The Open Science toolkit is composed of data management, understanding open data priorities, and open communication and engagement.

On data management, a lot of data is being produced and the SGCs must start developing systems to manage the data, which requires the understanding of the data life cycle and its specific capacities needs (data management planning → active data management → appraisal & risk assessment → data preservation). In addition, to act in the OS space, Africa needs to meet the global standards, by having the data management

systems acquiring the Core Trust Seal of approval. Currently, there is only one (1) data management firm that has obtained the seal of approval (Data First, South Africa). This means that there is a model already that the SGCs could look to in case they want to develop such standards data management systems. The Institutional Repository (IR) lists about 165 institutions from African countries: Eastern Africa-60, Middle Africa-1; Northern Africa-30, Southern Africa-44, and Western Africa-30). Crucially, the Academy of Science for Africa (ASSAf), in collaboration with the Association of African Universities (AAU), have developed IR criteria for a trusted IRs.

On the open data priorities, there is need to understand the purpose of open data, the required infrastructure, good open data practices and the shared principles involved in open science. One of the principles that defines the purpose is that Africa should become a leader in OS, in order to produce contextual knowledge. In addition, there is need to create a critical mass, produce skilled people, stimulate innovation and become a data rich continent. When thinking about shared principles, we need to ask ourselves about the limits of access, regulations and standards, ethics, and efficient licensing/copyright. On infrastructures, we need to think of: high performance computing, cloud computing, broadband networks, trusted data centres, machine learning & analytics, and societal portals, among others. On good open data practices, we need to think of among others FAIR (Findable, Accessible, Interoperable, and Reusable).

The Ebola Crisis is an example of a complex issue that is still being addressed through OS. Unfortunately, Africa are participants in the challenge: after the challenge is solved, all the data is taken away from the continent. In the event of a resurgence, Africa may not be able to address this same challenge effectively, hence the need to have leadership in OS.

On open communication and engagement, its purpose should be guided by purpose, e.g. sharing scientific results with all at affordable costs and jointly creating actionable knowledge with all societal stakeholders. Its principles could be that knowledge has to be accessible and comprehensible to all wishing to use it, and that scientists must publish the evidence (data) in the fullest way for any published claim.

Case examples given of anecdotal evidences OS practices in Africa include: Ethiopia launched their Open Data/Access policy where all the universities will have their data open for all research conducted using public funds; Tanzania has D-Lab that is promoting OS; South Africa has a policy as well as the square kilometre area (SKA); Botswana have its open data forum that allows for interactions between governments and stakeholders; Senegal is part of the H3 Bioinformatics framework; Zambia is a member of PlanS-the only country in Africa that has signed up for PlanS; Burkina Faso has a Government Open Science Website where public data is freely available, in addition the Agridata-BF is an initiative that uses four (4) local languages and they distribute climate smart data to farmers and the SGCs can learn from this initiative; Egypt has launched the Egyptian knowledge book where paywalls are removed for research conducted by Egyptians; and the African Open Science Platform. The current international publishing model does not favour Africa, and it is not going to favour open access and OS.

AN EFFICIENT OPEN SCIENCE ECOLOGY

The H3ABioNet Informatics network was presented as a model for open science, a pan-African informatics network that provides bioinformatics infrastructure and supports the H3Africa Consortium. Borrowing from this model, the goal is to set up platforms comprising of data bases, biomatics, interoperability structures and industry orientation.

THE OPERATIONAL GOAL IS TO SET UP PLATFORMS

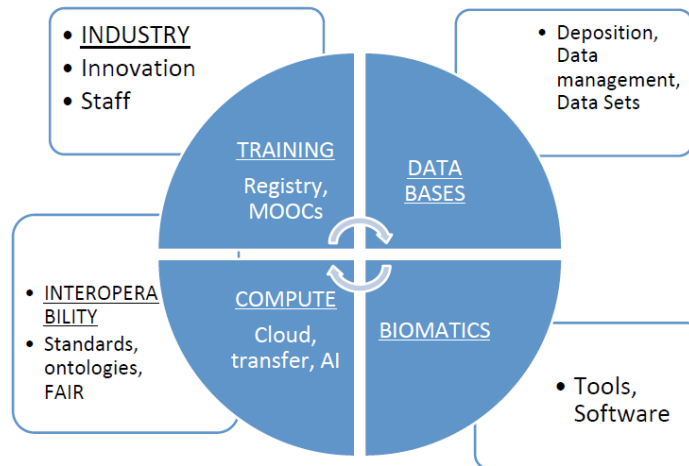


Figure 1: The Operational Goal is to Setup Platforms

However, this looks like an uphill battle being aware of the challenges present, where there is unawareness of the challenge, lack of political leadership, inadequate science investment, poor ICT connectivity, obsolete equipment, scarce high performance computing (HPC) facilities, a lack of training opportunities and a lack of secure data storage.

POSSIBLE ROLES FOR SGCs

The STISA 2024 report presents some structural issues including low rates of knowledge development (0.74% of global, few critical masses and low intra-Africa research collaboration. The priority roles of the SGCs therefore is to: use their unique intermediary position to influence and be influenced by mobilising resources, and creating scientific communities in ensuring their effective utilisation; use their potential to tap into collective actions; and make the case with their governments for OS.

The recommendations issued to the SGCs through this report include:

- They should choose their levels of ambition;
- Commission expert reviews; and
- Build consensus with key players.

There is need to mobilise the right mind-set, rather than more funding. Africa has everything it needs, in real terms, borrowing the words of President Paul Kagame. With such ambitions, the view from the top would change, where we have efficiencies of scale, build collaborations, scale-up through shared capacities, create through diversity, and amplify impact through common purpose and voice.

OPEN SCIENCE IN RESEARCH AND DEVELOPMENT: SGCS' PERSPECTIVES AND RESPONSES

Facilitator: **Teboho Moja**, New York University, USA

Susan Muzite, Research Council of Zimbabwe

Hamidou Tamboura, Fonds National de la Recherche et de l'Innovation pour le Développement, Burkina Faso

Annette Ouattara, Programme d'Appui Stratégique à la Recherche, Côte d'Ivoire

Dirce Madeira, Fundo Nacional de Investigação, Mozambique

Having heard the propositions put forward through the Masterclass presentation, selected African SGCs were called upon to offer their perspectives on OS, based on their experiences in their countries.

SUSAN MUZITE, RESEARCH COUNCIL OF ZIMBABWE - ZIMBABWE

The Research Council of Zimbabwe has been promoting scientific and technological capabilities of institutions and individual scientists to solve the development problems of Zimbabwe and is fully committed to open science in research and innovation for development. However, evidence seems to show that Research Data Management, as an integral part of the open science ecosystem needs capacitation and strengthening to enable the Council to manage the science systems more effectively.

On Zimbabwe's experience on OS environment, the question was posed on what their priorities are in setting up national data management centre(s) that promote FAIR data in OS, and whether such centres would require articulation to regional data management centres. Ms Muzite confirmed the country's commitment to transformatively scale, with respect to development of women's capacity, and with respect to investing in infrastructure for OS platforms. In May 2019, the GRC had a meeting in Sao Paulo where the AOSP together with four other major worldwide OS initiatives issued a statement on OS to make sciences readily available as a public good. In Sep 2019 in Cairo, Egypt the AOSP designed implementation proposals. Zimbabwe is still at the level of active dialogue with stakeholders including researchers, universities and others including government. They are advocating for an agency to come up with state recommendations. Therefore, the RCZ looked forward to deliberate with other SGCI partners on how to move forward with the OS agenda. RCZ is committed to move with others with respect to capacity building, infrastructure and implementation.

On institutions, Zimbabwe is setting up a geo-spatial and space agency for data collection. Some of the areas where the agency would intervene include application of fertilisers with precision, among others.

ANNETTE OUATTARA, PROGRAMME D'APPUI STRATEGIQUE A LA RECHERCHE SCIENTIFIQUE – PASRES

Sub-Saharan Africa is home to four non-African languages, English, French, Portuguese, Arabic and many African language groups. An open science initiative will need to take this issue seriously, partly because much of Africa's meaningful production of knowledge for innovation cannot be readily separated from its indigenous linguistic and cultural contexts.

On how the Strategic Support Program for Scientific Research (PASRES) can help promote production of knowledge for innovation and development that reflect Cote d'Ivoire's indigenous and linguistic contexts in the proposed Open Science eco-system, Dr Ouattara responded that the first mandate of PASRES is to facilitate the knowledge production for innovation. She first remarked that the production of formal knowledge is done in only one language, French, while the local languages are isolated. Secondly, OS is a relatively new concept in Cote d'Ivoire where knowledge diffusion is still done through traditional through scientific publications. Scientific communication is done by scientists addressed towards their fellow scientists, of which what is considered important is academic acknowledgement among peers. In the perspectives of promoting OS in R&D in Cote d'Ivoire, PASRES could first of all work to promote an ecosystem that is compatible with the OS system. It would be important to reinforce the communication systems for better connectivity. Following this, PASRES could work towards setting up a legal and regulatory system well adapted to manage researchers' intellectual properties and facilitate access to knowledge. In addition, the system put in place through OS needs to take into consideration scientific requirements. PASRES could also include in its contracts a clause that obligates at

least one publication to be made open access for any work that has been done through PASRES financing. On the generalisation of their

Would this work for other Science Granting Council member states? Would this help to make science more inclusive in Africa? Does the PASRES see a strategic role for the Centre for Advanced African Studies (CASAS) in Cape Town (South Africa) in providing language research capacity support to the Science Granting Councils in Africa? What role can African universities play to promote indigenous languages as mediums for knowledge and innovation production and dissemination on the Internet in an open science ecosystem?

- Q: How can PASRES help promote the production of knowledge that reflects indigenous, linguistic contexts
- A (French): I am Ouattara, responsable de. La premiere mission du PASRES. Il est bon de noter 2 choses. Le francais est le plan...les langues natales ne sont pas. La diffusion de
- A (English) : We can produce knowledge in one language and diffuse this in more languages

DIRCE MADEIRA, FUNDO NACIONAL DE INVESTIGAÇÃO, MOZAMBIQUE

Background: In the promotion of scientific research for innovation and development in Mozambique, the Fundo Nacional de Investigaçã, has to deal with the complexities of Mozambique's official language systems of Portuguese and English, which are not only visible in the country's economic and political systems, but in social landscapes such as education. With particular reference to education, the science system is built on the Portuguese language and is presumably being transferred to English to align with the majority of science systems in the other Science Granting Council member countries. Added to this, there are several indigenous languages that are widely spoken by the people of Mozambique.

Question: What would be the linguistic challenges of Fundo Nacional de Investigaçã, in advocating and implementing open science in Mozambique? How would the Fundo Nacional de Investigaçã promote open publishing and open access given these linguistic complexities? What role should the indigenous languages play in open science in research and innovation for development in Mozambique and in a possible open science area amongst the SGCs? To operationalize open publishing and open access in Mozambique, which of the two proposed publishing routes;- Gold and Green would be favoured? What is the reason for this?

Dirce Madeira

- A: Portuguese is the official language of Mozambique
- A: It is necessary that Portuguese be made a language of science

HAMIDOU TAMBOURA, FONDS NATIONAL DE LA RECHERCHE ET DE L'INNOVATION POUR LE DÉVELOPPEMENT, BURKINA FASO

Background: The National Fund for Research and Innovation for Development of Burkina Faso has made significant progress on open science for innovation and development. For example, Burkina Faso's open data platform provides the public with reusable data from public administration, the private sector and civil society. Furthermore, the research competence center (CoC) of the West African Science Services on Adapted Land Use (WASCAL) is based in Ouagadougou (Burkina Faso) enabling the National Fund to coordinate, through its local agencies, activities between West African States and other international organisations such as the Global Open Data on Agriculture and Nutrition (GODAN) as part of the Africa Geospatial and Internet Conference.

General discussions

Toboho: Is open science the key?

- Muzite: it links availability of data, emergence of new systems to solve bread and butter systems. Meeting of minds to motivate funding on all levels

- Dirce: it raises more funds for research but brings what researchers need the training and capacity to do better research
- Annette: si les résultats scientifiques sont diffusés vers le grand public, cela permettra d'accroître le financement (if the scientific results are disseminated to the general public, this will increase funding).

Toboho : what kind of collaborations are needed ?

- Si les données générées ne sont pas communiquées...donc on ne peut pas. S'il n'y a pas de culture de communication...il n'y a pas d'infrastructure de base...on ne peut pas (If the data generated is not communicated and there is no basic infrastructure, we cannot collaborate)

Toboho : Who is connecting with regional data management centres?

- Muzite : They support the African platform
- Hamidou: nous avons mis en place une plateforme qui mettra en place des individus... (we have set up a platform of individuals)
- Annette : le secteur privé peut avoir des (the private sector can)

Toboho : with the scientific revolution there is a lot of anticipation. What is your one main concern given the dark side of Open Science?

- Annette: researchers should be ready to share the results of their research with the others

FACILITATED DISCUSSIONS ON THE MASTERCLASS PAPER BY MR. ALFRED SUMANI, NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY, ZAMBIA AND ALDO STROEBEL, NATIONAL RESEARCH FOUNDATION, SOUTH AFRICA

A general dialogue on Open Science (OS) in research and innovation for development that followed showed that delegates were very enthused with the concept and are willing to learn more about it with the hope of deploying aspects of the OS in their respective Council's operations. Some key issues that were highlighted during the facilitated discussion session are described below:

- All aspects of knowledge can fit into open science especially when it can be useful to the society. Nevertheless, both public and private goods are derived from knowledge and can influence how knowledge can be made open.
- For open science to become effective and efficient in Africa, there is need to invest in data, infrastructure, funding, human resources and capacity building at all levels.
- There is need to set up guidelines and incentives for open science to work. A researcher must know his gain in sharing his data with an outsider for there to be a mutual benefit and cooperation.
- There is need to package the concept of open science to benefit the youth and women who may eventually become vulnerable in getting access to data and information as the case may be.
- The extent of being open in an open science era calls for what can be made open and what cannot be made open depending on the sensitivity of the data or information.
- The issue of ethics is fundamental to open science.
- There is need to mount open science campaigns across the SGCs and other science system actors to make them fully aware of the concept and its operations as well as get adequate buy-in from the stakeholders.

- The open science agenda will lead to a facilitated and enhanced knowledge production considering that inventors and researchers most times will not have to re-invent the wheel again because there is available data and information to use as a benchmark.
- Considering that the open science concept is new, there is great need to grow a new crop of researchers that will embrace the new concept, popularise and adopt it in their operations.
- In order to institutionalize open science, there is need to promote policies in favour of open science just like we have in other advanced countries such as United Kingdom.
- All data and outputs from publicly funded research should observe the standard operating procedures of open science.

KEY RECOMMENDATIONS

Noting that Open Science presents an opportunity to address the complexities of development, the delegates resolved as follows:

- **Policies and strategies for managing data:** Noting that data is the fuel that drives open science, the delegates called upon African governments to enact and harmonize policies, strategies and incentives for data acquisition, publication, use and disposal.
- **Capacity and infrastructure for computing:** Delegates emphasized the need for enhanced computational ability for the continent to harness the potential for open science. This should be accompanied by skills and capacity enhancement, support for researcher mobility, sustainable funding and creation of accredited data centres.
- **Joint approaches and collective action:** There's need for increased intra-African collaborations in both the generation of knowledge (research) as well as in its application (innovation). Such collaborative action could focus on African grand challenges such as food security, climate change, disease burden etc. or build on on-going continental initiatives such as the African free Continental Trade Area (AfCTA).
- **Community and consensus building:** Continuous dialogue is required to set priorities, goals and ambitions. There's need to create platforms and forums for regular engagement of the different players including public and private sectors as well as the funders.
- **Linguistic and cultural diversity:** Noting that open science is embedded in cultural and institutional contexts characterized by diverse languages – English, French, Portuguese and Swahili as well as numerous dialects – the delegates emphasized the need to harness the opportunities presented by this diversity to promote valorization of research findings, enhance inclusivity and participation.
- **Strategic communication and public engagement:** Communication of scientific outputs to the community was identified as a weak link that undermines uptake of research findings. Delegates emphasized the need to exploit the opportunities under open science to promote sharing of information and strengthen knowledge use.
- **Data ownership, access and ethics:** Create frameworks to guide data ownership and access in collaborative partnerships