

Embracing open science agenda through coordinated approach: The Botswana case

Tuelo Ntlotlang

Botswana International University of Science and Technology, Botswana

ntlotlangt@biust.ac.bw

Abstract

A number of countries around the world have embraced the open science agenda. However, in some cases, existing legislative frameworks in most countries typically do not allow much openness of data and science. Botswana is an example of such countries. The absence of legislative framework poses a challenge to librarians, researchers and policy makers with regard to data sharing. This has derailed the country's development in terms of innovation and creativity. This issue has prompted different stakeholders to come together to work towards changing the current systems and regulatory frameworks in relation to open science and data management. The Botswana Open Data Open Science (ODOS) national committee was established in 2017 by different stakeholders being public bodies, business communities, information professionals and research communities to develop an open data open science policy that would enable data sharing and openness in science within the country. The purpose of this paper is to share the strategies used to establish inclusive interactions and engagement between stakeholders in facilitating the open data readiness implementation in Botswana. Moreover, the paper will highlight challenges encountered and achievement attained through this collaborative effort.

Keywords: Open science, Open data, Botswana Open Data Open Science, Open data policy, Legislative frameworks, Data management

Introduction

Open science movement has gained momentum that has aided a paradigm shift in the scientific information and research landscape. This shift was caused by the fourth industrial revolution where research or science is depending largely on the digital technology. This is

supported by Bahlai et al (2019), who states that open science emerged as a response to a transformative technological change and web connectivity. Therefore, this shows that open science is affecting all stages of scientific processes, including how data or information is created, stored, shared and preserved. Furthermore, open science provides opportunities for promoting knowledge sharing and collective collaboration through opening up access and visibility of research outputs in the digital format to the global community (Friesike et al, 2015). It aims at unlocking barriers that make research output unequally accessible to all.

Open science is a revolutionary concept, therefore different scholars and key players define it in different contexts. Dai, Shin and Smith (2018) share the same sentiment and they reported that open science

« in some communities is related with open access to scientific publications, for others it focuses on open access to research data while for others includes opening up the processes of academic research»

In this paper, open science is discussed in the context of opening up data, research findings as well as referring to the processes and structures that support data or information sharing and access to all through digital channels. This presentation will briefly discuss the strategies used by Botswana Open Data Open Science (ODOS) national committee to establish inclusive interactions and engagement between key stakeholders in facilitating the open data readiness implementation in Botswana. Challenges encountered and achievement attained through this collaborative effort will also be shared.

Brief Overview of Botswana

Botswana is a landlocked country that is situated in the southern region of the African continent. Its neighbouring countries are South Africa, Namibia, Zambia and Zimbabwe. Botswana is a semi-arid desert where the Kgalagadi desert occupied eighty per cent (80%) of the land. The population of Botswana is slightly over two (2) million.

Education system in Botswana

The education structure is made up of seven (7) years of primary education, five (5) years of secondary education and up to five (5) years of higher or tertiary education (Modise and Mosweunyane, 2014). Primary and secondary education is free for all with a minimal fee of development levy, for primary pupils is P60,00 (\$5.60) while for secondary students is P150,00 (\$14,00). For higher education, the government is providing financial support to students through the bursary.

Apart from formal education system, the government has introduced the literacy programme that is meant to provide literacy skills to people who missed the chance to benefit from the formal education system. Distance education is also one of the education methods that is delivered in the country. It has given the working class and those who have not been

given opportunity to attend the conventional education system to develop themselves through acquiring important skills and knowledge and even earning higher educational qualifications.

Research in Botswana

The government of Botswana is committed on promoting research and data that informs decision making and policies that would ultimately aid development and improvement of the economy and society. This is evident in the country's Vision 2036, where the government is calling for all the key players in research landscape to transform Botswana's economy from being of a resource base to a knowledge base. This shows that research is core and critical towards the attainment of this national vision. Another government commitment is the newly established Ministry of Tertiary Education, Research, Science and Technology (MoTE) that is responsible for policy on student financing, tertiary institutions and coordinating research, science and technology development. There are also government ministries and departments that have established research units that are responsible for conducting relevant research in their respective areas of their operations.

Research in the country is mostly undertaken by the universities both public and private as well as colleges of higher education. These higher education institutions are required to conduct, promote and facilitate research and scholarly investigations that would accelerate Botswana economic growth. Their findings should be able to be transformed into tangible applications and products and support the needs of the industry and society but they are not yet there as they are not well resourced and operating in silos.

The establishment of the parastatal organisations such as Human Resource Development Council (HRDC), Botswana Institute for Technology, Research and Innovation (BITRI), Botswana Innovation Hub (BIH), Botswana Qualifications Authority (BQA), National Food Technology Research (NAFTEC), Statistics Botswana and Botswana Institute for Development Policy Analysis (BIDPA), financial institutions as well as non-governmental organisations points to the development of a national research landscape that is mandated to generate and use data and information. The discussion above shows that there are many players or entities that carry out research and generate lots of data and information needed to solve the challenges that the society encounter but the question is, is the society really benefiting from these researches.

Open Science: Botswana's scenario

Even though Botswana has made good efforts in ensuring that research is undertaken, there are major challenges that constrain these efforts. These challenges include high unemployment rate especially among the youth which is 60% of the population, limited economic diversification and worsening climate change conditions. Therefore, these issues are derailing the national socio-economic advancement. However, Botswana should redesign and implement infrastructures, systems, structures and procedures that will ultimately enable

data sharing and openness in science. The openness in science would promote online free access and visibility of research and data to all. As a result of this development, industry players would have an opportunity to come up with new innovations and inventions that addresses the nation and globally issues.

Botswana's transformation should be aided by the legal frameworks, procedures, policies and infrastructures that aim at curbing societal challenges mentioned above, along with addressing issues of insufficient resources, working in silos, limited research funds and restricted access to data and information. Molutsi, Mwela and Raseroka (2016) reported that

« progress in this area is limited by lack of intra and inter institutional interactions that require data and information sharing»

They further point out that in the fourth industrial revolution, data and information sharing for development plays a crucial role in effective intra-national and international interaction within defined collaborative and partnership frameworks, but this is not the case of Botswana. Academic institutions, government ministries and departments, parastatal organisations, financial institutions, non-governmental organisations and private sector operate with data and information in silos, and this result in inaccessible and underutilised Botswana research. This matter eventually prompted dominant players in research landscape to establish Botswana Open Data Open Science (ODOS) national committee that focuses on building consensus on open data open science programme in Botswana. Data in this discussion is taken in the wider context to refer to all pieces of information and even research outputs. Data, be it produced, collected, stored, managed, distributed, preserved, used and computed is a critical element in the developmental cycle of any economy. Open data is viewed as data that is available, discoverable and reusable to all while open science is an overarching term referring to open access to publications, open research data, open government data, open research infrastructure as well as citizen science.

Botswana Open Data Open Science (ODOS) National Committee

Botswana Open Data Open Science (ODOS) national committee was established in year 2017 with the main mandate of facilitating the open data readiness implementation in Botswana. It has been noted that there is a major gap in coordination and accessibility of science or research and data produced in the country. The science and data lacks the legislative frameworks, and then this hinders the country to benefit from open data open science initiatives. The national committee's overall goals are to provide a coordinated and collaborative open data open science legislative frameworks; drive national dialogue that promote universal access to science and data in the country and lobby for creation of an enabling environment for the adoption and growth of open data and open science in Botswana.

The specific objectives of ODOS national committee is to collectively:

- Create an awareness and discussion on open data open science as an important component of ensuring that the country achieves its vision of becoming knowledge-based economy.
- Highlight the current data situation in Botswana through national conversations.
- Discuss needs and perceptions on open data.
- Develop legislative and policy framework of open data open science.

Botswana Open data Open Science (ODOS) national committee membership has a representation of:

- **Universities;** University of Botswana (UB), Botswana International University of Science and Technology (BIUST), Botswana University of Agriculture and Natural Resources (BUAN), Botswana Open University (BOU) and Botho University.
- **Government ministries and departments;** – Office of the President, Ministry of Tertiary Education Research, Science and Technology (MoTE) and Department of Research, Science and Technology (DRST).
- **Research and Innovation Institutes;** – Botswana Innovation Hub (BIH), Botswana Institute for Technology, Research and Innovation (BITRI) and National Food Technology Research (NAFTEC) and Institute of Development and Management (IDM).
- **Parastatal Organisations:** Botswana Communications Regulatory Authority (BOCRA), Botswana Fibre Networks (BOFINET) and Statistics Botswana
- **Private Institutions;** – Joint Minds Consult, Bit Brands Botswana.
- **Non-governmental organisations;**– Botswana Libraries Consortium, Botswana Library Association.

The committee is made up of a network of people from a variety of disciplines such as academia, researchers, policy makers, journalists and librarians, innovators and entrepreneurs. The governance structure of ODOS national committee is made up of the chairperson, deputy chairperson, secretariat and members.

ODOS focus areas are:

- a. **Data legislation, governance and policy.** Focuses on assessing the current data legislation pieces and policies in relation to the aspect of data openness as well as exploring the opportunities of benefiting from the regional and global initiatives that will results in developing suitable open data frameworks that shall drive economic transformation.
- b. **Coordinated research data cyber infrastructure:** Facilitates discussions on issues around developments, deployments and operationalisation of a coordinated research data cyber infrastructure and its components. Persuades

the government to make available technology infrastructure that ensures data sharing in conjunction with system interoperability.

- c. **Data management and repositories:** Capacitates key actors of science to develop trusted digital repositories as well as promoting adoption of international standards and best practices to digital preservation, dissemination and facilitating sharing of data openly to the community.
- d. **Data awareness and capacity building:** Facilitates discussions on processes of developing and strengthening skills, abilities and knowledge on issues surrounding the creation, collection, redistribution, availability and reusability of open data.
- e. **Data for innovation and development:** Explores the opportunities that can be gained through the availability of open data sets that would bear results on data innovation, data products, data analytics and decision making. Facilitates discussions on how open data can and should play a role in enforcing development outcomes that would contribute to sustainable development goals.

Botswana ODOS national committee inclusive interactions and engagement strategies

The national ODOS committee employed the following strategies to establish inclusive interactions and engage both the key stakeholders and society on advancing the national dialogue on issues of open data and open science.

1. Local partnership and collaboration strategy

The University of Botswana (UB) has taken the role of providing national leadership on issues surrounding open data open science concept in the country. The national ODOS committee chairperson, who is the Dean of Faculty of Sciences–UB, issued a formal communication to all institutions to nominate a permanent member to the committee so that open science issues can be deliberated with the multi-stakeholder input. The institutions responded with a positive feedback, this is attested by the composition of membership mentioned earlier in this paper.

2. Stakeholder engagement strategy

2.1 Executive management workshop: The committee facilitated the chief executive officers' workshop that aimed at sharing thoughts on how the country can benefit from opportunities brought by open science movement. It was also meant to raise awareness on the intention to develop a national policy that will be instrumental in helping the country to open up wealth of knowledge from the country's researchers to the world. This initiated necessary support at senior level because they acknowledged the importance of open science as critical needs and as enabler for development and innovation.

2.2 National Forum: The forum was organised to bring all key stakeholders together to discuss the establishment of open data policy along with coming up with its concrete implementation plan. Furthermore, it aimed at initiating a national dialogue on open data and open science talks as well as kick starting the development of a data policy framework in the country. The forum was attended by 200 participants from different disciplines such as librarians, researchers, policy makers, information and communication technology (ICT) professionals, university vice chancellors and heads of research institutes. Topics that were discussed on the forum focused on the ODOS focus areas that are mentioned earlier. These areas were discussed on break away sessions through panel discussions that sought to examine the current strengths, weaknesses, opportunities and threats (SWOT) of the current open data environment. The overall concern raised was that the current frameworks and practices do not support much openness of data and science, hence the overarching recommendation from each breakaway session calling for an effective policy and legislative frameworks within the country. Institutions were also urged to align their roles so that they can embrace and promote ODOS initiatives within their mandates.

3. International collaboration

The national ODOS committee partnered with international institutions such as ISC Committee on Data for Science and Technology (CODATA), Research Data Alliance (RDA), ISC World Data System (WDS) and the Academy of Science of South Africa (ASSAF) to organise and host the International Data Week (IDW) 2018. The IDW 2018 was attended by more than 800 participants from around the globe being researchers, policy makers, data scientists and stewards, industry leaders and entrepreneurs. The scientific conference addressed the frontiers of data in research as well as creating awareness and advocating for high quality research data that can be managed and preserved in a Findable, Accessible, Interoperable and Reusable (FAIR) ways. It was engaged with a range of activities such as plenary panels, discussions and presentations focusing on research issues in a global and digital age, applications, progress and challenges of data intensive research and data infrastructure and enabling practices for international and collaborative research.

Botswana ODOS national committee Achievements

Below are the ODOS national committee accomplishments gained through engagement strategies;

- A draft national ODOS implementation strategy developed which is to serve as a precursor while waiting for a policy.

- Hosted International Data Week 2018 in November 2018
- Held a national forum in October 2017 and followed by a feedback session in March 2018.

Botswana ODOS national committee challenges

The national committee is experiencing the following challenges:

- Lack of budget or funds for the national committee.
- Shortage of critical skills such as research data management is still low in the country.
- Lack of infrastructural development that support data dissemination and access.
- Poor internet connectivity and power supply.
- Slow pace of change of culture regarding data sharing.

Botswana ODOS national committee recommendations

To overcome the problems mentioned above, the national committee should focus on the below recommendations:

- Financial investments are requested by the committee to fulfil its mandate, therefore it should appeal to national and international funders to support their initiatives.
- Botswana research data management practitioners and other key players should take advantage of capacity building programmes delivered by international institutions like CODATA and RDA to develop themselves. The ODOS committee should also encourage its members to use these opportunities.
- All key actors such as BOCRA, BOFINET and the government should work together in ensuring that information technology infrastructure is fully functioning, along with providing reliable internet connectivity. On another note, Botswana Power Corporation should also make sure that power supply is stable and reliable in the country.
- Advocacy programme with a focus of educating and engaging the society about openness of data should be developed and implemented by the national committee.

Conclusion

Efforts have been made to bring the government on board on issues of open data agenda. The government's participation on ODOS initiatives is a positive move that shows commitment of addressing issues of data openness and its inaccessibility within the country. Therefore, as a nation we should applaud the ODOS committee for leading the country into the right direction of making Botswana research data more open and as well as working collectively to remove the structural barriers that currently prevent universal access to all. ODOS committee should continue with more engagements and collaboration to all key stakeholders including the members of public to attain what is called citizen science and Botswana as a country will be able to achieve its vision of knowledge-based society.

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