The Future of Science and Science for the Future: The African Open Science Platform
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Laying the foundations

In late 2016 a preparatory pilot for the Platform was begun, funded by the South African Government’s Department of Science and Technology (DST) through the National Research Foundation (NRF), the International Science Council (ISC) and its Committee on Data for Science and Technology (CODATA); and managed by an AOSP Office hosted by the Academy of Science of South Africa (ASSAf) under direction of CODATA. Its priorities are to:

a) To map the current landscape of data/science initiatives in Africa.

b) Build a Pan-African open science community and encouraging the formation of national open science fora. A notable and crucial success of the pilot in this regard has been development of an African community of practice and support. The strategy has addressed both national entities (e.g. Ministries of Science, ITCs or Environment, National Councils for Science and Technology, data gathering initiatives and universities) and pan-African or regional bodies (the African Academy of Sciences and NASAC for academies, AAU and RUFORUM for universities, WACREN and Ubuntunet for NRENs). Meetings have included participants from Botswana, Burkina Faso, Cameroon, Côte d’Ivoire, Ethiopia, Ghana, Kenya, Madagascar, Morocco, Mozambique, Nigeria, South Africa, Tanzania, Uganda and Zimbabwe. Institutions involved in discussions include the African Academy of Science, the Association of African Universities, Ubuntu Net and the National Research and Education Networks (NRENs).

c) To develop frameworks for policy, incentives, training and technical requirements that will help in formation of the operational Platform.
Summary

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Preface: Status of the Document

The first draft of this strategy for the African Open Science Platform (AOSP) was developed as a result of an expert group meeting held in Pretoria in March 2018. It then formed the discussion document for a stakeholder meeting held in Pretoria on 3-4 September 2018. Resulting amendments have been incorporated in this strategy for the Platform, which will be launched at the Science Forum South Africa in December 2018. The March and September meetings involved a wide range of representatives from scientific bodies from across Africa, together with representatives of international bodies including UNESCO, the International Science Council (ISC), the Research Data Alliance (RDA) and the ISC Committee on Data (CODATA).

Summary

Open Science and the digital revolution: the imperative for action

The reality and potential of the modern storm of digital data together with pervasive communication have profound implications for society, the economy and for science. No state should fail to adapt its national intellectual infrastructure to exploit the benefits and minimise the risks this technology creates. Open Science is a vital enabler: in maintaining the rigour and reliability of science; in creatively integrating diverse data resources to address complex modern challenges; in open innovation and in engaging with other societal actors as knowledge partners in tackling shared problems. It is fundamental to realisation of the SDGs.

The challenge for Africa. National science systems worldwide are struggling to adapt to this new paradigm. The alternatives are to do so or risk stagnating in a scientific backwater, isolated from creative streams of social, cultural and economic opportunity. Africa should adapt, but in its own way, and as a leader not a follower, with its own broader, more societally-engaged priorities. It should seize the challenge with boldness and resolution by creating an African Open Science Platform, with the potential to be a powerful lever of social, cultural and scientific vitality and of economic development.

The African Open Science Platform. The Platform’s mission is to put African scientists at the cutting edge of contemporary, data-intensive science as a fundamental resource for a modern society. Its building blocks are:

- a federated hardware, communications and software infrastructure, including policies and enabling practices to support open science in the digital era;
- a network of excellence in open science that supports scientists and other societal actors in accumulating and using modern data resources to maximise scientific, social and economic benefit.

These objectives will be realised through six related strands of activity:

Strand 1: A federated network of computational facilities and services.
Strand 2: Software tools and advice on policies and practices of research data management.
Strand 3: A Data Science and AI Institute at the cutting edge of data analytics.
Strand 4: Priority application programmes: e.g. cities, disease, biosphere, agriculture.
Strand 5: A Network for Education and Skills in data and information.

The document also outlines the proposed governance, membership and management structure of the Platform, the approach to initial funding, immediate priorities and targets for 3-5 year horizons.
1. The Digital Revolution

1.1 The means by which information and knowledge are acquired, stored and communicated have always been powerful drivers of human material and social progress. Humanity is now in the throes of a digital revolution in these processes. It is changing societies, their economies and the lives of individuals in unprecedented ways, and with enormous potential for science and its application to the public good.

It offers great possibilities for Africa, which, if seized with boldness and imagination, have the potential to support scientific, economic and social dynamism that can help advance the energies and potentials of the continent.

2. What is it about?

2.1 In the early years of the millennium, digital processes overtook analogue processes as means of acquiring, storing and communicating information, with a massive decrease in cost and increase in flexibility. It has had the consequence that, globally, we daily acquire and store information that is the equivalent of 100,000 times the whole corpus of the Library of Congress. In 2003, it was announced that the human genome had been sequenced for the first time. It had taken ten years and cost $10 billion. Today it takes two days and costs less than $1000.

2.2 Modern digital technologies permit any device with its own source of power to acquire non-trivial information about its environment. These technologies are ushering in changes that permit science to progress from understanding relatively simple systems, where it has made profound contributions to the stock of human knowledge, to describing and analysing the highly complex systems that are at the heart of major global challenges, including the Sustainable Development Goals. Coupled to the World-Wide Web and the ubiquitous communication devices that are accessible to all, the digital revolution offers an opportunity to democratize knowledge in unprecedented ways.

2.3 Powerful digital processes for data acquisition have created streams of so-called “Big Data”, that flood into storage at high speeds, from scientific instruments and experiments, from business transactions and from social media. But equally important and arguably more interesting is “Broad Data”. This refers to the wide variety of data, some “big”, some “small”, that reflect different aspects of the same complex phenomenon. Such diverse data, when integrated, can reveal deep, hitherto undiscovered relationships in such complex systems as the operation of cities, the spread and impact of infectious disease, the analysis of social deprivation, the operation of the biosphere, and in many other scientific, social, economic and business domains. The rapid diversification of powerful machine learning technologies promises to “supercharge” the digital revolution through major impacts in most sectors of society.
3. **Why Open Science?**

3.1 If science is to exploit this potential, it must break out of its siloes in which individuals and groups tend only to have access to a limited range of data that reflect individual disciplinary focus. Scientists have a choice, either to have access only to that data that they create, or to have access to a much wider range of data from many disciplines, which is the necessary pre-requisite for addressing the complexities of this world.

*We should move on from a world in which maintaining exclusive access to data we have created has been a key to scientific discovery and its application, to one where data access is the priority. One can either hoard little, or access a lot. The former is an island – the latter is an ocean. It is a transition that science must make if it is to exploit the digital revolution in supercharging scientific discovery in a data-rich era. Without this shift to a regime where researchers are able to access a wide diversity of data streams, which, when integrated, reveal deep patterns in complex phenomena, the scientific community will fail to seize opportunities for unraveling the complexity of the major environmental, economic and societal challenges that it faces.*

3.2 However, although such a change is central to the public good, it is inimical to many current practices amongst scientists and their institutions. The idea that data that are generally acquired from publicly funded research are retained by scientists or by their institutions for their exclusive use is deeply engrained. The public good argument should take precedence, with scientists and institutions moving from a model of retention and hoarding to one of access, with support from metrics, regulation and incentives that recognize, reward and encourage new patterns of behaviour.

3.3 Many use the term "open science" to refer only to open data and open access publishing. But, in practice, this only represents scientists talking to other scientists, albeit more efficiently. In a world where pre-existing international structures and norms are increasingly disrupted or questioned, where the impacts of science on individuals and societies is so great, and where the emerging potential of data-enabled artificial intelligence in intensifying such impacts is becoming clearer, it is not enough for science alone to create solutions and to expect society meekly to follow. Private and public sector actors, citizens and civic societal groups need to be engaged with scientists in exploring and promoting economic and societal futures.

3.4 In this setting, it is imperative that science becomes a more public enterprise that engages actively with business, policymakers, governments, communities and citizens as knowledge partners in jointly framing questions and jointly seeking solutions rather than one conducted behind closed laboratory and library doors. Greater dialogue and engagement with civic society in open, transdisciplinary science is vital if the voice of science is to contribute effectively to public solutions. Open Science is a powerful paradigm that also meshes with and is integral to concepts of open innovation, in both society and business, which is most productive when there is effective open access to data and information.

4. **What does it offer to societies and economies?**

4.1 Economically, digital platforms are examples of a general-purpose technology, one that continually transforms itself, progressively penetrating new domains, boosting productivity across all sectors and industries because of its cost effectiveness and with an economic impact that is much higher than stand-alone technologies. It is a rare phenomenon, of which history only has three other examples: the steam engine, the electricity generator, and the printing press. These technologies bring enormous long-term benefits, but by their very nature, are highly disruptive, precisely because they are so flexible and pervasive. *Many benefits come not simply from adopting the technology, but from adapting to it.* And the revolution is well under way, redefining relationships between customers, workers, and employers, and permeating almost everything we do, progressively overhauling all industries whilst creating new ones. But the revolution is not over. Quantum computing may be just over the horizon, with the potential to render even many recent technologies obsolete, whilst the applications of machine learning are already doing so. Specific examples of powerful, digitally-enabled, cost-saving, labour saving, increasingly efficient applications abound, and are increasing daily in almost all areas of life.

4.2 Such are the implications of these developments that no state should be unaware of them, fail to develop relevant individual and institutional capacities in them and to embed them in their national intellectual infrastructure: in education, in the national science base, in public administration and in the commercial sector. Failure to do so risks falling behind in these domains and in the national economies that depend upon them.

*A country that fails to develop its own capacities will inevitably become dependent upon skills bought in from elsewhere as a passive and ill-informed consumer of expensive data services, lacking the creativity to thrive in a fast-changing world.*
There is an inescapable economic choice to be made that is illustrated by the history of other general-purpose technologies. Whilst there is a risk that even by strenuous, adaptive digital policies, a state's economic performance could lose “market share” because of the creativity of other better-favoured economies, but failure to adapt at all would certainly lead to serious economic deterioration.

On this basis, for a state to do other than equip itself to the best of its abilities with the skills, the support mechanisms and the opportunities for translation of cutting-edge digital technologies would be unwise in the extreme.

But what of the direct economic benefits of open science, and crucially, of the open data model which is the bedrock of the open science paradigm? A commonly debated issue in Africa is whether the net economic effect of open data would be positive or negative. A World Bank study\(^1\) concludes that the economic potential of open data is very large indeed, and that these conclusions apply equally to both developed and under-developed economies. It suggests that governments should see themselves not only as a supplier of open data but also as a leader, catalyst and user. A study for the European Commission\(^2\) argued that a European open data portal would have the potential to generate a multi-billion euro bonus per year, including a cumulative efficiency benefit of 1.7 Bn euros by 2020. Another report offers a deliberately conservative estimate of the opportunity costs (benefits foregone) for the European Union of not developing an open data that is findable, accessible, interoperable and reusable (FAIR data) as at least 10.2 Bn and possibly as high as 26 Bn euros.\(^3\) These considerations form a fundamental justification for the major investment in the European Open Science Cloud.

5. Potential down sides of the digital revolution?

5.1 Major technological developments tend not only to present beneficial opportunities but also create problems and dangers. So it is with the digital revolution and with open science. There are ethical and legal problems of ownership, access, privacy of data subjects and data governance; disruptive consequences for the world of work; limits to openness in relation to security and safety; the threat of cyber crime, political and electoral subversion and cyber warfare; and the potential of artificial intelligence, through the creation autonomous systems, to threaten human autonomy. The web for example, though a revolutionary agent of social interaction, is indifferent to falsehood and truthfulness. It has been described as having “the most prodigious capacity to spread lies the world has ever seen.”

5.2 Eschewing the technology for these reasons is not an option. Working to mitigate its dangers is the only route. Equipping society with the means to cope with these dangers, as well as capturing the technology's benefits, is vital, and a crucial responsibility for science, for governments and for national science systems. Without a deep, developed scientific capability not only will a society be unable through its own devices to capture the benefits of the digital revolution, it will lay itself open to be unprotected against its dangers. “All that is necessary for the triumph of evil is that good “people” (sic) do nothing.”


6.1 The preceding arguments provide a powerful rationale for developing strong African capacities to capture the benefits and avoid the pitfalls of the digital revolution.

The response is to create an African Open Science Platform to provide African scientists with the necessary tools and concepts for open science, the stimulus for excellence in science, and pathways to its application in the environment, business and society.

The Platform will facilitate data-intensive, solutions-oriented research, bringing scientists and non-scientists together as knowledge partners in open networks of collaborative learning and problem solving. In this way the Platform will drive the creation of actionable knowledge and strengthen the credibility, practical relevance and socio-political legitimacy of science in and for Africa.


\(^3\) PWC EU Services report ‘Cost of not having FAIR research data’.
6.2 The fundamental argument for the Platform to be Pan-African in scope is based on the observation that the size, diversity and interactivity of a science community are keys to its vitality, dynamism and creativity. The European Union and the USA are two global research powerhouses that exemplify these attributes. The diversity of Africa is a potential strength, not a weakness. Africa must mobilise this latent strength to exploit its potential. For individual African states, particularly low and middle income countries where the science community is small and poorly funded, to go it alone, with national procedures, national legislations, and national regulations, would be to miss a major opportunity for benefit and risk some of the outcomes summarized in paragraph 4.2.

6.3 Integral to such an argument for Pan-African reach include:

- providing major efficiencies of scale in planning, procurement and provision;
- scaling-up the scientific effort through collaboration and shared capacities;
- stimulating dynamism and creativity through the interaction of different experiences and inspirations;
- amplifying impact through common intellectual purpose and voice;
- and thereby creating the vital opportunities that young, creative African scientists need to develop and exploit their skills.

6.4 Analogous benefits accrue to adhering national systems because of:

- access to larger, more diverse resources than are available nationally;
- building consortia and collaborations with a greater critical mass and critical diversity than national systems alone can provide;
- support from a shared capacity in cutting-edge data science;
- a powerful means of sharing new ideas;
- an organised effort to develop trusted data repositories in key areas of African concern;
- becoming a partner of choice in international consortia.

6.5 Success will depend upon commitment to a bold vision, with collaboration at its heart, on results-oriented planning and implementation, on flexibility and experimentation, on effective and adventurous outreach, and on early action and persistence. At its best, the Platform could be a powerful lever for social, cultural and scientific vitality and economic development in Africa.
7. Vision

7.1 African scientists are at the cutting edge of contemporary, data-intensive science as a fundamental resource for a modern society. They are innovative global exponents and advocates of Open Science, and leaders in addressing African and Global Challenges.

8. Mission

8.1 The African Open Science Platform will convene and coordinate the interests, ideas, people, institutions and resources needed to advocate and to advance open science in and for Africa. The Platform is:

- a federated system that provides scientists and other societal actors with the means to find, deposit, manage, share and reuse data, software and metadata in pursuing their interests;
- a network providing connective tissue between dispersed actors in pursuit of shared and overlapping open science goals by:
  - supporting scientists in pursuit of the highest levels of excellence, in both curiosity-driven and application-driven research;
  - enabling consortia that wish to utilise powerful digital tools and cutting-edge data science to address important scientific problems;
  - developing open science capacities in individuals and institutions at all levels of public and private domains;
  - creating and supporting networks of engagement between scientists and other societal actors in open innovation and in addressing local, national and international issues of major public concern.

9. Contribution to strategic science priorities for Africa

9.1 The Science, Technology and Innovation Strategy for Africa 2024 (www.STISA-2024) sets out priorities for the African research community. They are:

a) Disease prevention & control
b) Climate resilience (disaster risk)
c) Environmental protection (biosphere, hydrosphere)
d) Food and nutritional security
e) Smart resilient cities
f) Sustainability goals
g) Improved knowledge production (e.g. only about 0.74% of global knowledge is created within Africa)
h) Improved intra-Africa research collaboration

It is recognised that the long-term success in achieving these priorities will depend upon increased rates of wealth creation in Africa and its states.
9.2 The platform is designed to contribute to these priorities in two ways:

• by stimulating the African research enterprise through ready access to a common research-supporting environment that exploits the potentials of a data-intensive era (priorities 9.1g-h);
• by creating programmes targeted at key priorities, such as those in the text box below, to stimulate pan-African collaboration, facilitation of relevant data access, and provision of high level technical support (priorities 9.1 a-f).

Furthermore, the promotion of deeper engagement with wider society (see 10.8) enhances the potential impact of socially relevant programmes as a distinctive attribute of the “open science” approach of the African Platform.

10. Activities

10.1 Determining the optimal operational activities for the Platform has, in part, been based on a baseline study carried out by the Pilot Project. This has mapped the current status of activities and capacities to create a live register of open data/open access/open science activities in the following categories:

• institutional open access policies and declarations (31 in number);
• open access/open data science initiatives addressing the Sustainable Development Goals (SDGs);
• capacity building programmes (currently over 13);
• capacities in cutting-edge computer science and artificial intelligence;
• operational systems for data collection, analysis, preservation, publishing/sharing, and data mining schemes;
• incentive schemes for open science;
• the locations and nature of scientific data repositories (currently 54 in number);
• institutional open access repositories (now over 165);
• high performance computing centres;
• national research and educational networks (NRENs), and the regional consortia of these networks (ASREN - North Africa; WACREN - West and Central Africa; UbuntuNet - Eastern and Southern Africa) providing computational facilities.

There has been considerable support from the European Union in enhancing high capacity internet connections through AfricaConnect2, and through the pan-European GÉANT, which will further strengthen Europe’s links with the African continent, and with a gateway for global collaborations, to the benefit of the African research and education communities.

10.2 Based on the above analysis, and on expressions of need set out in existing strategic analyses for Africa, Platform activities are planned that comprise two complementary sets: enabling activities (strands 1-2) that provide and manage access to data, computational hardware, connectivity and the tools and concepts required for effective open science policies and practice; and applications activities (strands 3-6), directed towards productive scientific, societal and economic outputs and outcomes. These have been analysed in depth by the Technical Advisory Board (see 11.1) and are summarised below.

Enabling Activities

10.3 **Strand 1: Provision of cloud computing facilities that provide networked computation, data access and analysis tools for African Science.**

*Activity:* Promoting and realising, together with partners, the creation of a federated African network of existing and new facilities, with a research cloud offering state-of-the-art computing in centralised environments, complemented by distributed device nodes at the edge of the network, to provide flexible and economically efficient computational capacity, data stewardship and networking services to users. The AOSP is advocating and promoting the further development and coordination of Educational and Research Networks, planning to accelerate and coordinate the participation in the global ecosystem for Open and FAIR data and working with others to promote and deliver an African Open Science Cloud providing more seamless access to data and computing capacity.

10.4 **Strand 2: Provision of software tools, experience-based advice on research data management and on open science policies and practice.**

*Activity:* The principles, policies, practices and data and publication tools that have been found to be of value in maintaining an Open Science environment have been collated during the Platform pilot phase, and will be maintained by engagement with the CODATA network of expertise as international experience evolves. Adaptation to African needs, where necessary, will be managed through a ‘Tools Network’ which will also organise regional meetings to create awareness of available tools. The national fora currently being created will also be a communication route for the maintenance of best practice in national systems.
Application Activities

10.5 **Strand 3: Create and sustain high level, internationally competitive research capacity in data analytics and artificial intelligence in support of platform science priorities.** This will provide a fundamental resource for the Platform in ensuring that researchers have access to novel, state-of-the-art data analytic tools, and particularly of AI, which are making dramatic advances in the productive use of data resources.

**Activity:** Create an African Artificial Intelligence and Data Science Institute with a three-fold function:

- to be an innovative centre for cutting-edge research on data analytics and artificial intelligence, that is strongly connected to the best international work in the domain;
- to develop data scientists and data engineers able provide the data analytic and AI skills needed to support data intensive applications in both public and private sectors and to provide a source of talent for data science research;
- to provide support in the application of appropriate analytic techniques to platform users and to priority research challenges (see Strand 4).

Consideration is being given to a structure based on a number of dispersed centres, but co-located or associated with existing bodies in cognate areas (e.g. mathematics/computer science etc) to ensure that each centre has a significant critical mass.

10.6 **Strand 4: Programmes of data-intensive research that place African scientists at the international forefront in the application of data technologies to major research domains, as a fundamental resource for a modern society.**

**Activity:** Programmes will be developed that stimulate intra-African collaboration, identified as a priority in the *Science, Technology and Innovation Strategy for Africa 2024*, in major data-intensive programmes in science areas where Africa is data-asset rich, where domain scientists are active, which are important to African states, and that have the potential to attract collaboration with the best scientific institutions world-wide. It would be a potentially powerful route to the development of the African research base and of the much-needed intra-African collaboration identified by the strategy. The examples of such programmes as shown in the text box below would also provide essential underpinnings for several of the Sustainable Development Goals (SDGs). A major initiative of the Committee on Data (CODATA) of the International Science Council (ISC) to integrate diverse data relating to a complex phenomenon could provide a novel multidisciplinary data backbone for many such programmes. The current absence of such an integrative capacity to characterise complexity undermines attempts to define pathways to global sustainability.

**Strand 4: Examples of possible priority programmes.**

The following are examples of potential data-intensive programmes that fulfill the criteria for strand 4 and where the Platform could provide a powerful frame for policymakers and public and private users:

**Biodiversity:** Africa is a hot-spot of global biodiversity. Increased understanding of biosphere dynamics in such a setting is a route to understanding how global biodiversity might be preserved in the face of human inroads. It could be globally significant. South Africa is a node of the Global Biodiversity Information Facility.

**Disease:** The burden of disease in a major issue for Africa. New data-intensive ways to identify and treat non-communicable disease and predicting, detecting and responding to infectious disease outbreaks could have a major impact on this burden. Targeting disabling diseases which have the greatest individual and societal impacts together with remote diagnosis and the development of local treatment capacities that are well adapted to need are fundamental to efficient use of national resources.

**Resilient Cities:** Rapid population growth and urbanisation continue to diminish the capability of governments to tackle urban development challenges, which are particularly exacerbated by inequality, poverty and uncontrolled development of urban slums. Cities are highly complex organisms. New methods to integrate multivariate urban data can reveal patterns of association as a basis for optimal urban planning. Reliable and accurate development data on the underlying distributions, patterns, trends or disparities are critical for urban planners and governments in making effective decisions.
Disaster Risk Reduction: Climate-related disasters, such as desertification, famine and flooding have been particularly common in Africa. They have significantly set back progress towards sustainable development in many African countries. Increased incidents of disasters involve new risks and a rise in disaster related losses, have significant economic, social, health, cultural and environmental impacts in the short, medium and long term, especially at local community levels.

Open innovation: There is great potential in Africa for open innovation that utilises digitally-intensive tools such as big and broad data, AI technologies and robotics combined with relatively cheap and accessible techniques such as 3D printing, where production is in the hands of the many and not the few. The Platform could be a means of bringing these tools into the mainstream, so that they can be seized upon by policy makers and businesses to develop distinctive productive solutions.

Agriculture: The rise of digital agriculture and its related technologies has opened a wealth of new data opportunities. Remote sensors, satellites, and UAVs can gather information 24 hours per day, monitoring plant health, soil condition, temperature, humidity, etc. Such data on local conditions, categorized and correlated using machine-learning algorithms, can identify optimal farming practice to maximise yields, plan production and predict outcomes.

The Ghana Atomic Energy Commission (GAEC) and the South African SKA project collaborated to build a Radio Astronomy Observatory at Kutunse, Ghana.
11. Governance, membership and partnerships

Governance

11.1 The AOSP will build on the foundations developed during a pilot phase of the Platform, expanding and reorienting governance to ensure pan-African participation and engagement. The AOSP pilot, which runs until 2019, is governed by an Advisory Council, supported by a Technical Advisory Board responsible for identifying and addressing technical priorities. The pilot is currently supported by a team based in the Academy of Sciences of South Africa (ASSAf), under the direction of CODATA. The current membership of these bodies was determined by agreement between the Department of Science and Technology (DST) and the National Research Foundation of South Africa (NRF), ISC and CODATA, who have funded the pilot phase.

11.2 The AOSP will have a Governing Council responsible for strategic development of the Platform, expanded to reflect growing membership. Rather than a single Technical Advisory Board, responsible for addressing technical priorities, it may be preferable to have advisory boards or working groups for each of the activity strands, all reporting to the Governing Council and comprising representatives of members that take the lead in developing/implementing the work strands. The Governing Council will appoint a team responsible for management and coordination of the Platform and its activities.

Members

11.3 Members of the Platform should be institutions with a pan-African, regional or national remit, interest or responsibility for the design and delivery of the Platform and its activities as described in 10.0. They will invest resources (financial and/or in-kind) and will be engaged in particular work strands. Governance of the Platform will be accountable to Members. Members should commit to self-funding participation in annual AOSP membership meetings or if elected/appointed to work strand groups or the Governing Council. Examples of relevant members are:

- Universities and their representative bodies (Association of African Universities, the African Research Universities Alliance, individual research-intensive universities) and institutions such as the African Institute for Mathematical Sciences.
- Science academies (African Academy of Sciences, the Network of African Academies of Science, and individual academies).
- African Science Granting Councils.
- Service providers such as the National Research and Education Networks (NRENs), the pan-African H3Africa and H3BioNet initiatives, the Square Kilometre Array (SKA) partnership in Africa, the South African Data Intensive Research Cloud (SADIRC), the African Observatory for Science, Technology and Innovation (AOSTI), research consortia, and private sector service providers.

National Forums

11.4 These should be a special class of member. They are currently being developed as a basis for articulating national priorities, ensuring that national communities are aware of the opportunities offered by the Platform, and working to stimulate national use of those opportunities. They are a key to realising Platform goals at the national level.

Knowledge Partners

11.5 Knowledge partners will be activity-based users of the work strands described in section 10.0. It is a category that will develop as these evolve. For example, the Network on Open Science Access and Dialogue could reach out to NGOs, and the Network on Education and Skills could engage with national educational advisory councils, or even to individual schools, in the provision of curricula. Knowledge partners might also be members if their activities justify this status, and would play a role in discussions about creative development of the Platform.

Sponsors

11.6 The Platform will seek to attract African and international sponsors to:

- support resource mobilisation;
- facilitate global networking and profiling of the AOSP;
- provide advice and participate in strategy development.

Potential sponsors include the African Union, appropriate regional bodies, the International Science Council (ISC), ISC-CODATA, ISC-WDS (World Data System), RDA (Research Data Alliance), the international GO FAIR initiative, UNESCO, and the United Nations University.
Financing

11.7 Support for the key strands of the Platform’s activities during the start-up and early growth phases will be sought from National Governments of African countries as well as from African and international bodies concerned with capacity development in Africa. The latter would include the African Development Bank, the World Bank, International Development Agencies, Donor Aid Agencies and Foundations and Philanthropic bodies. The following financing horizons are identified:

- **Year 1 (2019):** establishing finance for platform management as described in 11.2 and 12.2.
- **To end of year 3 (2021):** Start-up financing for the activities of strands 1-6, primarily from external donors;
- **To end of year 5 (2023):** Financing of core Platform capacities to be provided by members, with project-based financing from external funders.

12. Launch and Development

12.1 The African Open Science Platform will be launched at Science Forum South Africa 2018 in December 2018.

Start-up management

12.2 The initial management hub will have a complement comprising:

- A Director
- Four Platform Officers
  - Data science
  - Data stewardship
  - Training and skills
  - Network building, communications and outreach
- An administrative officer

Operational strands

12.3 The Technical Advisory Board of the pilot phase AOSP has been responsible for planning for the creation of individual operational strands as described in section 10, with the collaboration and support of CODATA. Although it is conceived that optimal benefit from the Platform will be delivered when the Strands interact strongly, they are also able to act independently, and can therefore be individually launched as and when planning, funding and recruitment are sufficient for their tasks.

12.4 Although the long-term objective is for the Platform to have pan-African scope, it is anticipated that its initial growth will take place by:

- Coordination of effort between institutions in a smaller number of states that are able and willing to align their scientific data-related policies and practices to create mutual benefit through the functions identified in 10;
- Agreements for collaboration between existing service providers and coordination of their activities to maximise benefit to the African science community.

12.5 It is important to recognise that developments can be rapid, and should be wherever possible. India leapt to prominence in IT in the 90s through strong, concerted efforts. There is a great opportunity for Africa to emulate this, as the fixed infrastructure is a comparatively small cost compared to the policy/workforce changes that are necessary for a successfully operating open science enterprise.
13. Forward Planning

Priorities

13.1 The Platform will be launched with planning targets that will permit performance and development to be evaluated, and corrected where necessary. It is planned that the enabling capacities (strands 1-2) will be in place and application strands (3-6) will be operating within three years (by 2021); and that there will be significant achievements from the application strands within 5 years (by 2023). The priority for the first period will be to establish, by the end of 2021, full operational capacity involving:

a) Governance, partnerships and financing
   - increasing the representation of founding members on the Advisory Council;
   - definitive representative governance processes working effectively (including Council and Technical Advisory Board or its successor bodies);
   - engagement with potential funders;
   - commitments to engagement from international sponsors;
   - agreements with federated service partners;
   - agreements with national representative partners;
   - support from pan-African institutions and key cognate research institutions;
   - long-term, sustainable funding in place.

b) Operations
   - platform management structure working routinely and efficiently;
   - strands 1-6 (section 10) of the Platform established and operational;
   - priority research programmes in place;
   - major achievements (see 13.3) in the pipeline.

13.2 Work is currently under way to establish major collaborative priority research programmes, primarily involving academic partners. At this early stage, thematic issues that show clear potential to become priority programmes include disease, resilient cities and biodiversity, which coincide with African priorities in 9.1. In addition to the enabling capacities (strands 1-2), the creation of an African Data and AI Institute will be a priority for the first year (2019).

13.3 A crucial objective for the first 5-year period is to drive for significant achievements in the form of outputs that are of practical value in addressing issues such as those listed in 9.1. It is premature to predict where these outputs and related outcomes might arise. But an important priority in 2019 for the Technical Advisory Board is to engage with active researchers in creating fundable, Platform-based distributed networks of collaborating scientists addressing major issues for Africa.