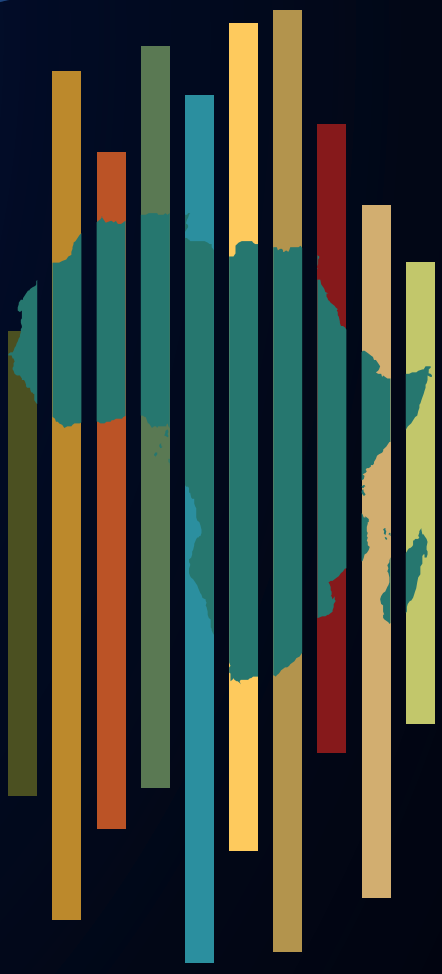
Africa Data Revolution Report 2018

STATUS AND EMERGING IMPACT OF OPEN DATA IN AFRICA



AFRICA DATA REVOLUTION REPORT 2018

THE STATUS AND EMERGING IMPACT OF OPEN DATA IN AFRICA

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Foreword

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The first biennial Africa Data Revolution Report was announced in January 2017 at the UN World Data Forum, and launched in July 2017 at the second Africa Open Data Conference in Accra, by United Nations Economic Commission for Africa (ECA), UNDP, Open Data for Development, and the World Wide Web Foundation amongst other partners. This first (2016) Report recognised African countries' pledge to achieve sustainable development and inclusive growth for all following the adoption of the 2030 Agenda for Sustainable Development and the African Union Agenda 2063. It further highlighted the challenges and opportunities for a data revolution in the continent that was sprung out of these agendas.

The 2016 Report addressed issues on the process of transforming national data ecosystems, from the status quo to an aspirational state where data from both conventional and new sources are being harnessed to inform decision-making better and enable sustainable development with contributions from diverse data communities. The report aimed to assist countries on the continent in charting their way towards strengthened national data ecosystems by identifying common problems, sharing home-grown examples and lessons learned and came up with actionable recommendations applicable in the regional, national and local contexts. It also reviewed the current state of data ecosystems in Africa at the start of the 2030 Agenda era, in terms of the diversity of data actors and their capacity needs, legislative and policy frameworks, technological infrastructure, tools and platforms, and the dynamic interactions between them.

The drive for data openness is recognised as a priority for sustainable development. In July 2015, during the Addis Ababa Action Agenda of the Third International Conference on Financing for Development, UN member states noted the importance of drawing on new, open data sources to meet user needs. In January 2017, during the first World Data Forum in Cape Town, South Africa, the High-level Group for Partnership, Coordination and Capacity-Building for statistics for the 2030 Agenda for Sustainable Development (HLG-PCCB) introduced the Cape Town Global Action Plan for Sustainable Development Data. Among the key objectives of the Global Action Plan is to modernise governance and institutional frameworks to allow national statistical systems to meet the demands and opportunities of constantly evolving data ecosystems. In order to achieve these objectives, member states agreed to take action to explore ways of revising the Fundamental Principles of Official Statistics to include relevant and appropriate aspects of open data initiatives, and to encourage national statistical offices to embrace open data initiatives and ensure stakeholders of the national statistical system as part of the process.

As an answer to these imposing challenges and needed actions posed in front of African national statistical systems, this second report focuses on the theme of open data in Africa. The report will discuss the current status of, and recent evolution in open data – with the emphasis on Open Government Data – in the African data communities, based on the findings of the Africa Open Data Barometer and the Africa Open Data Index. Given that there is a sizable gap between some of the promised benefits of open data by the sometimes over-enthusiastic data evangelists and the actual outcomes, the report also undertakes a more in-depth, critical assessment of the impact of open data so far, by means of six in-depth qualitative country case studies, selected for diversity and regional representativeness. General recommendations are made in terms of improving the overall status of Open Government Data, but more specific policies and actions are suggested to increase the actual impact of OGD initiatives. This second report has been written not only with policymakers in mind, but it was also written in such a way that it will be relevant to donor agencies and other partners, the open data community, and general readers.

Acknowledgements

This report is the joint product of the following collaborating institutions: the United Nations Economic Commission for Africa (ECA), the United Nations Development Programme (UNDP), the Open Data for Development Network and the World Wide Web Foundation. These institutions were represented by a Steering Committee composed of Molla Hunegnaw (ECA), Serge Kapto and Alessandra Casazza (UNDP), Fernando Perini (International Development Research Centre of Canada) and Nnenna Nwakanma (World Wide Web Foundation), together with the lead author of the report, Jean-Paul Van Belle of the Centre for IT and National Development in Africa. UNDP's contribution was made possible thanks to the generous support of the Ministry of Foreign Affairs of the Republic of Korea. The Open Data for Development is funded by the International Development Research Centre, the Government of Canada and the Flora and William Hewlett Foundation, all of which were indispensable for the production of this report.

Under the supervision of the Steering Committee, the report was put together by a team of country researchers headed by the lead author Jean-Paul van Belle (University of Cape Town) with co-authors Paul Mungai (University of Cape Town) - Kenya; Mboneni Hlabano (University of Cape Town) – South Africa; Hubeidatu Nuhu (University of Cape Town) – Ghana; Sarang Chaudhary (Berkeley University) – Rwanda and Tarik Nesh-Nash (GovRight) – Morocco (together with Jean-Paul Van Belle). The country researchers produced six background papers for this report. They received support from various national statistical offices and UNDP country offices including those in Kenya, Rwanda, South Africa, Ghana, Burkina Faso and Morocco.

Carlos Iglesias (World Wide Web Foundation) and Danny Lämmerhirt (Open Knowledge International) coordinated and wrote the Africa-specific 2018 Open Data Barometer and Open Data Index sections, respectively. They were assisted by the regional coordinators Muchiri Nyaggah and Dickson Minjire (African Open Data Network - AODN); Nagla Rizk; and Nancy Salem (Access to Knowledge for Development - A2K4D) and Idriss Tinto (Francophone Africa Community of Open Data - CAFDO). The country researchers for the ODB/ODI data were: Hatem Ben Yacoub, Tomás Queface, Hubeidatu Nuhu, Worku Alemu, Mbongeni Hlabano, Paul Mungai, Claude Migisha, Abir Chérif, Lameck Mbangula, Sonigitu Asibong, Rowland Stevens, Mahadia Tunga, Bernard Sabiti, Maurice Thantan, Charlie Martial Ngounou, Assani Salim Azim, Emmanuel Bama, Blaise Ndola Baguma, Fofana Bagnoumana Bazo, Cyriac Gbogou, Ba Abdoulaye, Gaius Kowene, Fabienne Rafidiharinirina, Thomas Ayissi and Tobias Carlos. The report aimed to keep the original voices of the various co-authors as much as possible, hopefully lending more authenticity and flavour to the overall narrative.

This report benefited greatly from a consultative IODC pre-workshop in Buenos Aires, Argentina in September 2018. The following people provided comments on an early draft of the report: Chukwudozie Ezigbalike; Philip Thigo (Kenya); Davis Adieno (GPSDD); Emmy Chirchir; Peter Da Costa; Radhika Lal, Eunice Kamwendo and Serge Kapto (UNDP); Fernando Perini (IDRC); Charlie Martial Ngounou (AfroLeadership); Ana Brandusescu (Web Foundation); Kat Townsend (Fellow), Angela Kageni (DevInit); Stefaan Verhulst (GovLabs); Craig Hammer (World Bank); Codrina Marie Ilie; and Jennifer Walker. Of course, any remaining errors and any subjective positions taken in this report are solely the responsibility of the author. It is a testimony to the diversity among the contributors and reviewers that not all agree with every finding and recommendation contained in this report.

This report would have been impossible without the generous sharing of time and knowledge by numerous interviewees participating in the country case study research in Kenya, Ghana, South Africa, Rwanda, Burkina Faso and Morocco. They include social entrepreneurs, NGO, public administration officials, politicians, journalists and academics. The ethics protocol promised them anonymity (apart from a few who are, with consent, quoted explicitly); this prevents us from giving them their due credit publicly but, without their collaboration, this report would not have been possible. It is hoped that this report will contribute to the discussion and further the cause and impact of open data in Africa; thereby re-paying their commitment and dedication and that of many others who work selflessly to further open data on our beautiful and exciting continent.
The Authors, November 2018.

List of Abbreviations

ADRR	Africa Data Revolution Report
AfDB	African Development Bank Group
AODI	Africa Open Data Index
AODN	Africa Open Data Network
CAFDO	Communauté Afrique Francophone des Données Ouvertes
CCT	City of Cape Town
EDP	European Data Portal
EITI	Extractive Industries Transparency Initiative
GIS	Geographic Information System
GODAN	Global Open Data for Agriculture and Nutrition Network
ICT	Information and Communication Technology
ICT4D	Information and Communication Technologies for Development
ILO	International Labour Organisation
IODC	International Open Data Conference
NGO	Non-Governmental Organisation
NSO	National Statistics Office
OA	Open Access
ODB	Open Data Barometer
ODC	(International) Open Data Charter
ODI	Open Data Index (by OKI) or Open Data Institute
OD4D	Open Data for Development
OGD	Open Government Data
OKI	Open Knowledge International
SDGs	Sustainable Development Goals
UN	United Nations
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
WIEGO	Women in Informal Employment Globalizing and Organizing
WWF	World Wildlife Fund

Executive Summary

The Africa Data Revolution Report 2018 delves into the recent evolution and current state of open data – with an emphasis on Open Government Data – in the African data communities. It explores key countries across the continent, researches a wide range of open data initiatives, and benefits from global thematic expertise. This second edition improves on process, methodology and collaborative partnerships from the first edition. It draws from country reports, existing global and continental initiatives, and key experts' input, in order to provide a deep analysis of the actual impact of open data in the African context.

In particular, this report features a dedicated Open Data Barometer survey as well as a special 2018 Africa Open Data Index regional edition surveying the status and impact of open data and dataset availability in 30 African countries. The research is complemented with six in-depth qualitative case studies featuring the impact of open data in Kenya, South Africa (Cape Town), Ghana, Rwanda, Burkina Faso and Morocco. The report was critically reviewed by an eminent panel of experts.

Findings

In some governments, there is a slow iterative cycle between innovation, adoption, resistance and re-alignment before finally resulting in Open Government Data (OGD) institutionalization and eventual maturity. There is huge diversity between African governments in embracing open data, and each country presents a complex and unique picture.

In several African countries, there appears to be genuine political will to open up government-based datasets, not only for increased transparency but also to achieve economic impacts, social equity and stimulate innovation.

The role of open data intermediaries is crucial and has been insufficiently recognized in the African context. Open data in Africa needs a vibrant, dynamic, open and multi-tier data ecosystem if the datasets are to make a real impact. Citizens are rarely likely to access open data themselves. But the democratization of information and communication platforms has opened up opportunities among a large and diverse set of intermediaries to explore and combine relevant data sources, sometimes with private or leaked data. The news media, NGOs and advocacy groups, and to a much lesser extent academics and social or profit-driven entrepreneurs have shown that OGD can create real impact on the achievement of the SDGs.

Opening up election data has had an immeasurable impact on the transparency and acceptance of key elections in some countries. When open election data is supported with an independent observer system, a real-time and trustworthy communications infrastructure and a vibrant news media community, it has in several noteworthy instances contributed to peaceful democratic elections in sensitive and fragile political environments with outcomes relatively uncontested. Given the humanitarian cost of violent elections, and the incalculable benefits of a stable society and political environment necessary for any sustainable development progress, it can be argued that the positive and demonstrated benefit of just these few open election events alone more than justifies any and all historical investments made in OGD in Africa.

One set of stakeholders that has perhaps created a disproportionately large share of the impact is the fourth estate: the very small contingent of data-driven journalists. Not only did they play a crucial role in the open elections, but they continue to play a key part in promoting government transparency, advocacy of marginalised communities and building stronger democratic structures.

Key Recommendations

Open data needs the commitment of political leadership, to be entrusted to a dedicated and adequately resourced custodian, and embedded through permanent data processes and a pervasive culture within all relevant government institutions. This takes sustained leadership and commitment inspired by a true belief in the benefits of open data to society. It cannot be achieved by short-term standalone, once-off externally funded initiatives focused on purely quantitative objectives such as making a given number of datasets available.

Externally funded and partnership-driven Open Government Data projects need to increase their focus on local capacity-building within governments, insist on institutionalizing open data processes, ensure that the datasets released are the ones that

address local needs rather than those that are easy to open, and involve stakeholder consultations.

Don't let the perfect be the enemy of good. Although the political pressure for only publishing data of the highest standard of quality is recognized, in many cases imperfect, timely data is better than no or "too-late" data. Thus, this report advocates for the timely release of usable and useful datasets, even if imperfect, and while quality assurance is pending.

Additionally, a different type of intervention or support mechanism is required to improve the impact of open data initiatives: support for OGD intermediaries needs to be more agile, less formalized, easier to access, allowing for more failures (i.e. higher risk tolerance), and focused on multi-pronged and more holistic outcomes.

The intrinsic value of data as a strategic and social asset should be recognized by all the stakeholders in the data value chain, including those who capture the data as well as managers and decision makers at all levels of government institutions.

Other Recommendations

The following are some other recommendations provided in the report:

- Promote a shift in culture around the importance and ownership of government data.
- Move the emphasis in Open Government Data projects from inputs and outcomes to impacts.
- Query the need for strict open licensing.
- Reduce the number of 'official' open data portals.
- Release more data relevant to addressing the needs of vulnerable groups.
- Debate the balance between the public good versus the protection of privacy and national security.
- Involve users and other stakeholders in open data decisions; release more lower-quality datasets with explicit quality indicators and implement feedback mechanisms for crowdsourced quality improvement.
- Continue financial and technical support for the early phases of quality open data production through long term partnerships.
- Support and strengthen National Statistical Offices as the key drivers of national open data initiatives.
- Build open data capacity and change the prevailing (lack of) data culture in government.
- Promote more local and urban government open data initiatives.
- Recognise that the priorities of the global North are not the same as those of Africa.
- Pursue a balanced, context-sensitive approach to the issue of transparency and open data.
- Engage in a critical debate around the use of private and corporate data for the social good.
- Provide more micro-grants and support for open data intermediaries and demand-side stakeholders.
- Set up a data structure infrastructure to share information, research and best practices around using data for the SDGs.
- Involve and incentivize academic involvement.
- Strengthen and protect data journalism.

The report encourages national policy makers and international funding or development agencies to consider the status, impact and future of open data in Africa on the basis of this research. Other stakeholders working with or for open data can hopefully also learn from what is happening on the continent. It is hoped that the findings and recommendations contained in the report will form the basis of a robust, informed and dynamic debate around open government data in Africa.

1

INTRODUCTION

Africa needs to embrace and harness the unfolding data revolution[1]. The data revolution offers the continent a more realistic chance at baselining and tracking its progress towards the Africa Union's Agenda 2063 targets and the 2030 Agenda's Sustainable Development Goals (SDGs), than using only traditional statistics. More importantly, the world is moving inexorably towards the Fourth Industrial Revolution and becoming a knowledge society grounded in the data economy[2]. Africa cannot afford to be left behind; sticking to business-as-usual implies that Africa's economies would miss the wave and the gap with the economies that successfully exploit the value of data would keep widening[3].

The inaugural 2016 Africa Data Revolution Report (ADRR) was motivated primarily by the first challenge. It looked at how the emerging tools and techniques afforded by the data revolution could potentially assist the stakeholders in Africa's data ecosystem to gather higher quality and more disaggregated data in order to measure the numerous development indicators associated with the various national development plans, Africa Union's Agenda 2063 and the UN's 17 SDGs. The SDGs alone identify more than 230 indicators for which disaggregated microdata is crucial to ensure that the core objective of 'leaving no one behind' is met. Given that the traditional way of gathering national and local statistics is too resource-intensive, the 2016 ADRR explored the potential of big data and business analytics, (data) crowdsourcing, Internet-of-Things, low earth satellite imagery, mobile phone data harvesting, artificial intelligence techniques, and similar technologies at a high level. However, two years later few of these techniques have matured sufficiently to be extensively added to the traditional statistical arsenal of methods and tools.

One notable exception to the "Proof-of-Concept" status of most data revolution technologies, is the open data phenomenon. The open data[4] movement has gathered significant momentum; it has been embraced by numerous governments and other stakeholders around the world, and has resulted in a substantial body of empirical evidence testifying to its value and potential.

[1] As called for in the UN High Level Panel (2013) report for the post-2015 development agenda "A New Global Partnership".

[2] The data economy is an is economy centrally based on data, including data technologies, data products and data services (European Commission, 2017).

[3] The WEF (2017) "Future of Jobs and Skills in Africa" report highlights that between 41% and 52% of all jobs in Africa's largest economies are susceptible to ICT-driven automation. Mean while, ICT intensity of jobs has been increasing steeply (e.g. 26% in South Africa over the last decade) and ICT-intensive jobs become a major driver of economic growth (e.g. accounting for 18% of formal employment in Kenya). Since Africa has the largest and fastest growing young population, job creation is an imperative, not just to ensure social and economic development, but to avoid otherwise inevitable socio-political instability. However, the report rates the capacity of most African economies to adapt to this changing landscape as lagging seriously behind most other economies.

[4] The terms 'Open Data' and 'Open Government Data' are defined in the next section.

Numerous international development partners have invested significant amount of resources to promote open data in Africa. This prompted the decision to focus the second ADRR exclusively on the status and impact of Open Government Data (OGD) on the continent. Even more importantly, and in addition to its relative maturity vis-a-vis other data revolution technologies, open data has the advantage of contributing directly to achieving sustainable development priorities, rather than merely providing indicative data (see *Table 3: Example cases of OGD making an impact on specific SDGs.*)

Thus, this ADRR responds directly to the urgent call made at the 2016 International Open Data Conference:

> *"[We need to address] the insufficient integration of Open Data into the broader 'Data Revolution'. IODC 2016 featured an important reality check: Open Data and its related benefits do not exist in a closed environment. Concerted action is needed for Open Data, open government, and country-level data initiatives, such as those connected with the Sustainable Development Goals, to be mutually reinforcing. Open Data is more useful and actionable when it is a strategic element of a larger development initiative and not pushed forward as a standalone issue." (IODC, 2016, p.16)*

Another consideration is that, currently, open data is a relatively well delineated phenomenon (notwithstanding differences in opinion on the exact definition of open data). However, the unfolding data economy will create many more hybrid types of data along a continuum ranging from private, through restricted access, leaked and public, to completely open data. It will thus become ever more difficult to single out open data specifically or separately for measurement and impact. So *now* is the right time to look at open data: open data has matured sufficiently to provide a solid base of theoretical and empirical insights to determine and highlight issues, yet it is still early enough to propose policy improvements to change the course of open data implementation.

The imperative of Open Government Data for Africa

This ADRR is not intended to be an advocacy report for open data; rather its objective is to assess the current status and impact of open data in Africa. However, the sponsoring organisations and authors of this report are naturally not merely detached observers; they firmly believe in the exceptional value and contribution which open data can make towards Africa's development, and they trust that this report will lend convincing empirical support to this view. Without wanting to usurp the more eloquently formulated arguments made elsewhere (World Bank, 2015; ODI, 2013, 2015), we are thus obliged to provide at least a brief rationale for our belief in open data's crucial role in Africa's development landscape[5].

Commercial organisations, large and small, have implemented Information and Communication Technologies (ICTs) widely, thereby transforming the global economy into a knowledge economy and driving the shift towards what is called the Fourth Industrial Revolution[6]. We are already there: the market valuation of the world's largest corporations is based largely, if not entirely, on their data assets and capability to use them. Arguably the entire market capitalisation of Alphabet (Google), Alibaba, Facebook, Tencent can be attributed to their ability to derive value from their customer data. Most governments were slower to take up ICTs, although e-government – public sector organisations using ICTs to improve their activities – is now becoming more pervasive. As such, data is not only becoming far more important to the functioning of the government, but the electronic data stores are becoming a huge intangible asset. The value which governments can provide to their citizens will increasingly be based on their data stores. Unlike private organisations, government data has been paid for by the taxpayer and should, from a moral perspective, be used maximally for the public good. However, governments have traditionally been fairly conservative gatekeepers to their data stores,

[5] Despite the enthusiasm of Open Data advocates and supra-national organisations, the fact remains that open data is still not recognized for its incontestable value in the political arena, let alone sufficiently institutionalized. In fact, open data cannot be taken for granted even in the developed economies. As Verhulst (2017) warns for the US and elsewhere: "*the emergence of nationalist strongmen with limited faith in democracy around the world, is likely to affect the perceived value proposition and use of open data*" (p.2)

[6] *"Data lies at the core of the Fourth Industrial Revolution. This is an essential resource for economic growth, competitiveness, innovation, creation and society's progress in general."* Commissioner Mariya Gabriel as quoted in the very persuasive EDP (2017) "Economic Benefits of Open Data", p.7.

perhaps in the belief that they are best positioned to add value to the data, or that their data should be "sold" at a fair market value to create extra revenue streams. Luckily, some governments now realise that the production costs or market value of government data are very bad proxies for the societal benefits that can accrue, especially given that the marginal cost of data re-use is close to zero. The value of individual governmental datasets remains limited but, in mature data ecosystems, the innovative re-combination, augmentation and mining of multiple datasets from diverse sources can create benefits which are many multiples of that derived from the individual datasets alone. Where these have been quantified (see the *section: Approaches and frameworks for measuring open data impact*), the economic benefits amount to several percentages of GDP on an ongoing basis.

In a global economy which has already become an information-driven economy, much of the economic value generated is based on data and other knowledge assets. Therefore, African governments that insist on keeping their datasets closed are artificially and severely handicapping their very own economies by depriving them of the 'new oil' of today's knowledge economy. By not opening up data, they are entrenching existing inefficiencies in their economies, denying innovators opportunities, handicapping development initiatives while also making their economies unable to compete globally by retarding its transformation towards the data-driven paradigm.

Without wanting to minimise the real challenges faced in opening up data – such as conversion costs, privacy and legal concerns, internal political and institutional barriers, and other systemic concerns – it remains the sad truth that a government's unwillingness to accelerate its open data policy is tantamount to wilfully shackling economic development.

The above arguments speak to the necessity of government in recognizing the vital importance of data as the 'new oil' of the data economy and aiding their country in moving towards the fourth industrial revolution. However, the specific motivations for open data policies and projects are usually based on by specific impacts: economic benefits, transparency, better service delivery, innovation. As mentioned at the start of this section, these benefits and impacts are argued more eloquently in reports by the World Bank (2015), the ODI (2013, 2015) and many others. Additionally, section 7 refers specifically to the various impacts typically expected from open data, as well as giving specific examples on how open data can contribute directly to achieving the SDGs.

Three major impact categories – and therefore rationales – for open data were identified by Davies et al (2013) as follow (but with potential overlap). *"Transparency and accountability [political domain]: open data will bring about greater transparency, which in turn brings about greater accountability of key actors, leading to them making decisions and applying rules in the public interest; Innovation and economic development [economic domain]): open data will enable non-state innovators to improve public services or build new products and services with social and economic value; open data will shift certain decision making from the state into the market; Inclusion and empowerment [social domain]: open data will remove power imbalances that resulted from asymmetric information, and will bring new stakeholders into policy debates, giving marginalised groups a greater say in the creation and application of rules and policy."* (Davies et al, 2013, p.16)

The economic argument, however, requires an economy which can make use of the data provided; estimates of economic benefits in the developed economies are consequently often much higher than those in emerging and developing contexts. In Africa, open data projects are often undertaken to increase transparency and accountability, especially where governments have signed on to the Open Government Partnership and committed to open data as part of their OGP action agenda. However, a main inspiration for this research is the social impacts, specifically those relating directly to the SDGs (see *Table 3: Example cases of OGD making an impact on specific SDGs.*) as well as assisting in baselining and measuring progress towards the SDG indicators.

2 DEFINITIONS AND SCOPE

What is Open Data?

The International Open Data Charter (ODC) defines **open data** as *"publicly available data that can be universally and readily accessed, used and redistributed free of charge. It is structured for usability and computability."*[7] This definition sees open data as a sub-set of 'public data', any data which is available to the public. However, not all data has to conform to the strict ODC definition in order to be useful or make an impact; as Verhulst states:

> *"[…]This is a gold-standard definition of open data, an important target to work toward. In fact, the openness of data exists on a continuum, and many forms of data that are not strictly "open" in the sense defined above are nonetheless shareable and usable by third parties." (Verhulst & Young, 2017, p.7)*

It may be argued that a strict requirement of an open license is perhaps overly limiting in understanding the state and impact of open data in Africa[8]. There is a lot of *de facto* **public data** without appropriate license available which is being used to further development. Apart from the obvious fact that most official statistics are not open-licensed, many other governmental public datasets are making an impact, such as crime statistics, or perhaps more clearly, property transaction registers. Property sales data cannot just be used on their own to inform estate agents, property investors and others on market trends. However, if calibrated carefully, they could be used as proxies for influencing factors, such as environmental conditions or local school performance. Even the term public data – any data available for public access - is fuzzy, given that much of the data is available for public scrutiny but sometimes only in paper format, or it has to be scraped using inventive schemes. Other publicly accessible datasets were not initially intended to be public, for instance datasets created by scraping social networks, product sites or dating sites (often in breach of a website's terms of use) or leaked 'private' data released on WikiLeaks or elsewhere such as the Panama and Paradise papers. In addition, some

[7] https://opendatacharter.net/

[8] This is discussed further. However, it is not the intention to undermine the importance of the appropriate licenses for Open Data. Where these are not present, data users may face severe legal consequences, especially in those countries where the civic space is particularly constrained. However, in other African countries, things may be more relaxed than in developed countries.

although not nearly enough useful data collected by the private sector has been opened up under a number of different arrangements (as will be discussed in the recommendations later).

A subset of open data is **Open Government Data** (OGD) which is open data generated and released by local or regional Government ministries, departments and agencies (MDAs). Often the National Statistics Office (NSO), with its mandate to collect, approve the quality of, and release official statistics[9] , is also the key player in releasing OGD. However, many countries have created a distinct state organ for this purpose. Many different OGD technical platforms, URLs and interfaces are used to host or access the open data portals. However, moves are made towards a generic platform with concomitant support, functionality and quality benefits. For example, the open source CKAN and DKAN platforms have been widely adopted[10] , and used by many core national data portals[11] . Bello et al (2016) provide a detailed analysis of prominent African data portals as of 2015.

Besides OGD, other open datasets are created or curated by different stakeholders in the data ecosystem, including local and international NGOs, local governments, academic institutions and private organisations. This is discussed in more detail in *Section 4: Existing open data ecosystem and stakeholders*.

Scope

In terms of geographical scope, this report focuses specifically on the Africa continental region. Selected documents looking at open data use cases and impacts elsewhere in the world were also consulted. The time horizon for research focussed on events from the past three years, i.e. 2015-2018, as this space is particularly dynamic and various efforts have stalled or been abandoned. In rare cases reference is made to earlier events, usually to provide the necessary historical context. The previous Global Open Data Barometer[12] and ADRR were both published in 2016, but an Africa regional open data impact study did not feature before, hence the three-year time horizon.

[9] Statistics, by contrast, 'characterize' a sample or population e.g. they are a frequency count, weighted average, range, variance, sknewness or some other calculated characteristic. Open data refers to the underlying detailed or micro-records from which the statistics are often calculated. Because some level of aggregation is usually applied, even to detailed records, there is some overlap between the two concepts, especially when very 'low-level', disaggregated statistics are released.

[10] CKAN's website lists 197 public instances of python-based CKAN, most of which are local government or NGO portals. 39 national government portals are mentioned as using the CKAN software (although not necessarily all are the official) data portals, including Australia, Brazil, Canada, Croatia, Estonia, Germany, Indonesia, Ireland, Italy, Mexico, Netherlands, Paraguay, Romania, Slovakia, Sweden, Switzerland, UK, Uruguay, USA. African adopters include Morocco and Mozambique. Although Drupal-based DKAN's website lists fewer adopters (93), there are more instances running in Africa: including Namibia, South Africa, Ghana and Sierra Leone.

[11] See for example data.gov; data.go.id; dati.gov.it; datos.gob.mx; data.overheid.nl; data.gv.at; dados.gov.br.

[12] No specific African report was produced but a regional snapshot for Sub-Saharan Africa was made as part of the global edition. See https://opendatabarometer.org/4thedition/regional-snapshot/sub-s

3 METHODOLOGY

The two objectives of this report, measuring the current status and impact of open data in Africa, are at different levels of epistemological maturity. This results in the adoption of a hybrid but perhaps complementary methodology for this report.

The measurement of the status of OGD in various countries has been an ongoing effort by several organisations and numerous researchers. Although there is no absolute consensus, well-researched and time-tried standardised methodologies have been used for a while, resulting in a rich trove of internationally comparable data. Two efforts that stand out are the World Wide Web Foundation's African Edition of the Open Data Barometer (ODB), covering 29 countries, and the Open Knowledge International's Africa Open Data Index (AODI) across 30 African countries.

The Africa Open Data Index methodology

The Africa Open Data Index 2018 (AODI), using the Global Open Data Index methodology, is an online-based survey tool[13] assessing the availability, degree of digitisation, and openness of government data. It considers "key national datasets" across the following topical areas:

1. Administrative records: budgets, procurement information, company registers
2. Legislative data: national law
3. Statistical data: core economic statistics, health, gender, educational and environmental statistics
4. Infrastructural data
5. Agricultural data
6. Election results
7. Geographic information and land ownership

In cases where researchers did not find any national government data available online, they assessed whether data is collected sub-nationally or by

[13] http://test-african-data.survey.okfn.org/

private actors such as companies or NGOs based in the target country[14] . *"National data is considered to be one of the following: 1) data describing processes of government bodies at the highest administrative level (e.g. federal government budgets); 2) data produced by sub-national actors but collected by a national agency (e.g. a national statistics office)."*

If researchers were unable to see data online or to request copies from the government, the data was considered not to be made public by the government at all. The ODI assessment attributes an "openness score" to each country. Several questions are asked about the data producers, the degree of digitisation, accessibility, and provision of data under an open licence and in machine-readable formats. The scores of these questions are summed up to a total score. The highest possible score is 100 points, indicating that the data is fully open.

- 15 points were assigned if data is publicly available, either online, in digitised form, or as paper-based records.
- Another 45 points were given when data was updated, could be downloaded and was free of charge (15 points each).
- Open licensing, and machine readability resulted in another 20 points each.

All questions focused on the most accessible (preference is given for online data) and representative dataset (containing most data elements). Thereby the ODI methodology accounted for situations in which the government may provide more complete data which needs to be paid for or specifically requested. Such cases are noted but the openness of the more readily available dataset is actually assessed. In order to capture as much information as possible, it was decided not to use other condition chains, which could restrict the selection of datasets.

The Open Data Barometer methodology

The Open Data Barometer – African Edition seeks to repeat the analysis from previous Barometer editions following the International Open Data Charter Principles, with some methodological revisions and adaptations to the specific African context developed in collaboration with regional OD4D network partners:

- African Open Data Network (AODN)
- Francophone African Community of Open Data (CAFDO)
- Access to Knowledge for Development (A2K4D) Center at the American University in Cairo.

The Barometer does not measure readiness to start an open government data initiative, but rather readiness to secure positive outcomes from such an initiative. It consists of three components: (1) **Government**; (2) **Citizens and Civil Society**; and (3) **Entrepreneurs and Business**. Each of these groups are important for a successful OGD initiative. As Tim Berners-Lee has observed, open data *"has to start at the top, it has to start in the middle and it has to start at the bottom"*. On the other hand, measuring open data impact is notoriously difficult. Establishing a solid causal connection between open data and particular social and political changes is clearly beyond the scope of a survey such as the Barometer. However, for the purpose of the Barometer, claims made in credible sources concerning possible **uses and impacts of open data** are a useful proxy indicator for areas in which impact may be occurring, and to allow for initial comparison between countries.

The research for the Open Data Barometer is based on peer-reviewed expert survey responses between May and July 2018, asking trained country specialists to respond to a number of detailed questions about the open data situation in their specific countries following a detailed research handbook protocol[15]. Each question invited either a yes/no response or a quantitative response on a 0-10 scale, with detailed scoring guidance and thresholds provided. Researchers also provided justifications and citations for all scores. Responses were peer-reviewed, re-scored where required, and cross-checked by the research coordination and quality assurance team.

[14] These must be based in the country of reference (i,e, national organisation, or a national branch of an internationally operating organisation). Data from multilaterals, international organisations, or regional organisations (World Bank, African Union, UN agencies, etc) was excluded.

[15] The Africa Open Data Barometer 2018 methodology can be accessed at https://docs.google.com/document/d/1SW9RUbgbVHCqCD-Hd5TbT_DYQ8TwwryKblc4cBLBwXY/edit?usp=sharing, and the database at https://drive.google.com/file/d/1Jf4NdLAZm3yzkgM7bA7JzZIH6FS3aGZ9/view?usp=sharing

The country case-based impact methodology

Measuring the in-depth impact of open data on development is an emergent endeavour. Although the ODB includes a score for impact, it is by necessity a high-level and generalizable approach. It does not provide a more detailed, nuanced insight into the various 'on-the-ground' developmental and other impacts. Moreover, although some qualitative frameworks have been proposed (see section 7), they have not yet been tested on a scale that allows for international and historical comparison. Nor has agreement been reached among OGD researchers and organisations as to which is the best approach. Accordingly, an eclectic qualitative approach was taken and a case-study based method chosen, with the aim of exposing more nuanced, detailed views of impact. Additionally, the cases expose some of the dynamics around how open data becomes institutionalized (or not) and the pathways to impact. The case studies involved a combination of document analysis and interviews.

One of Africa's defining characteristics is its diversity: there is a wide range in economic activity levels, human development levels (e.g. as measured by the Human Development Index), geographic and cultural diversity, and many other indicators, among its 54 countries (McKay, 2015; Innis, 2017). Thus, a purposeful, stratified approach was taken to choose six countries while attempting to balance the following criteria:

- Size: small, medium and large countries (geographic and population);
- Open data maturity: stagnant, emergent/growing, and rebounding open data status including the top 2 ODB countries (2016), with the rest selected from the top 10 but with a minimum aggregate ODB score of 20;
- Geographical location: at least one country representative from North, West, East, and Southern Africa; as well as both landlocked and coastal countries;

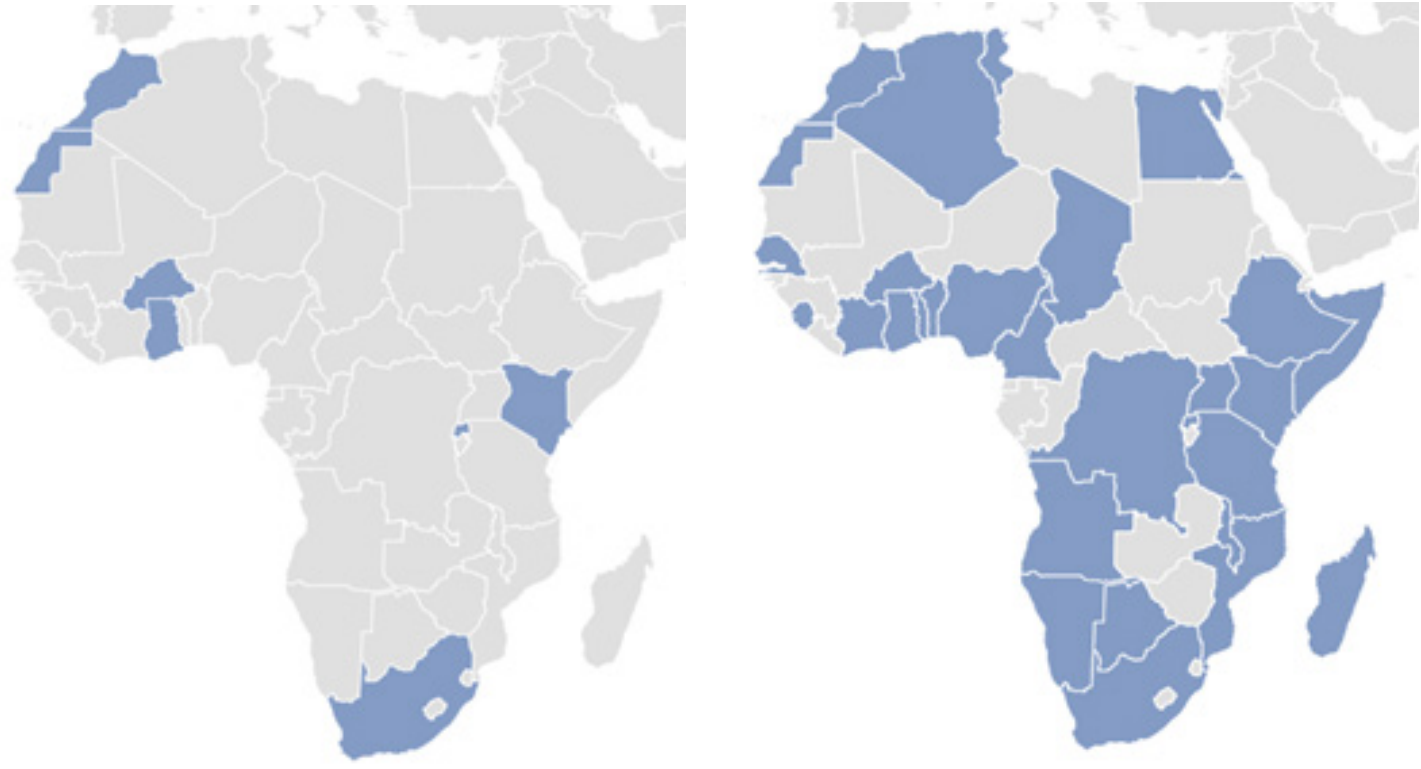

Figure 1: Countries selected for qualitative impact case study (left) and Open Data Barometer (right)

[16] No Lusophone country was included since none of them have initiated significant open data initiatives to date.

[17] It cannot be claimed that Cape Town represents a *typical* African city; but neither can the country cases be considered 'typical' or 'representative' of all African countries. The key purpose, however, is to show that it is possible – and perhaps sometimes more feasible and impactful – to implement an open data initiative at local government level, even if no such initiative is functional at the national level. This is a crucial point to make in the light of the fast urbanisation of Africa. Another example of a successful local government implementation of open data is Nigeria's Edo State; although many other successful initiatives highlighted in this report also take place in urban contexts.

- Language: officially Francophone or Anglophone[16] ;
- Development: diversity in economic and human development levels.

In the end, the following countries were selected:

- **South Africa** is an economically well-developed, large, populous country in Southern Africa with a robust infrastructure and strong historical capacity.
- **Kenya** is also one of the largest economies, located in East Africa, with a strong and long track record of open data.
- **Ghana** is a West-African, more agriculture-focussed, populous country with a much more recent open data development.
- **Rwanda** is a relatively small, land-locked, resource-poor country with a very nascent but quite committed open data focus.
- **Burkina Faso** is a West-African, francophone, relatively small country, with a low economic and development level.
- **Morocco:** a medium-sized, French-speaking North African country with historically strong statistical and governmental institutions and a relatively high level of development. It was an early adopter of open data, stagnated a few years ago but appears to have revived in the last year.

The interview protocol was inspired by a dedicated country-specific document analysis which took publicly available literature and other media into account. This allowed the respective country researcher to focus on specific historical and contextual developments and impacts. The core questions were around assessing the current state of open data and, most specifically, the actual impact which the open data initiatives had made.

Given that *"[t]he local level is where much government data is collected and stored, where there is strong likelihood that data will be published, and where data can generate the most impact when used"* (World Wide Web Foundation, 2016), it was deemed to be vital to include at least one local government-based case study. Because the national open data effort in South Africa appears to have stalled since 2016, this country was chosen to highlight the case of City of Cape Town[17] 's municipal government pursuing open data more vigorously.

4 EXISTING OPEN DATA ECOSYSTEMS AND STAKEHOLDERS

Traditionally, the main open data stakeholder targeted for international funding support has been the National Statistics Office (NSO). It is, rightly, seen as the custodian and largest provider of government datasets and, given that the cost of data collection has already been funded by the taxpayer, releasing them freely as open data should have no significant budget implications. Furthermore, much of the expected impacts relating to socio-economic development, innovation and the social good, are among the major policy drivers of government. Finally, open data as a key driver of government transparency is seen as a desirable goal in its own right by many supra-national organisations, especially for young and emerging democracies. The NSOs usually have the most resources to handle data, including toolsets, infrastructure, data analysis, data collection and quality control processes. Thus, the open data space in most countries has come to be dominated, on the *supply side* of open data at least, by NSOs, or sometimes specially constituted agencies which typically work in close liaison with the NSOs. Some stakeholders appear to treat open data as *de facto* synonymous with *Open Government Data*. An NSO-based open data initiative in Africa is often initiated as one of the actions undertaken when the national government signs the Open Government Partnership (OGP), thereby committing itself to use a concrete action plan to transparency which is easily achieved through open data. In theory, national or local governments committed to open data might be expected to sign the Open Data Charter (ODC), but to date, only one African government has signed it.

Nevertheless, many other players are providing open data. The table below gives some illustrative examples of key open data portals or datasets released by the different types of open data providers.

Table 1: Examples of useful open datasets curated by different types of stakeholders.

Stakeholder	Open/Public Data Examples[18]
National and Local Government (OGD)	National: data.gov.za; data.gov.bf; www.opendata.go.ke, …. Local: opendata.capetown.gov.za; data.edostate.gov.ng
Supra-national institutions and agencies	United Nations agencies, The World Bank, African Development Bank, and many other organisations release data which is sometimes not available elsewhere. Such data may be submitted directly by government agencies to the organisations, or they may have their own data collection mechanisms. Notably, some of this data is based on models and some of it is harmonised for international comparability.
NGOs	openAFRICA, the largest independent repository of open data in Africa, data provided by numerous (57 as of August 2018) organisations and individuals; curated by Code4Africa
Commercial (for profit) Organisations	Examples: e.g. Uber's releasing traffic data for selected cities currently Cairo, Nairobi and Johannesburg/Pretoria.[19] Orange releasing CDR micro-data for Côte d'Ivoire and Senegal for the D4D Challenge.
Academia ("Open Research")	Ouma *et al* (2018) published a geocoded database of 4908 hospitals covering *all* 48 SSA countries as part of their Wellcome Trust sponsored research on access to emergency hospitals[20] . OpenAIR is a researcher network across Africa and Canada, promoting and coordinating open research into innovative solutions for core African problems (SDGs). In May 2018, the University of Cape Town approved an "Open Research Data"-by-default policy with "immediate" effect.[21]
Citizens: "Crowdsourced" Data	OpenStreetMap, e.g. the "Project Espace OSM Francophone (EOF)" project in Francophone West Africa (Mali, Benin, Togo, Senegal, Côte d'Ivoire, Burkina Faso and Niger) WikiData makes crowdsourced information from Wikipedia but also academic and other datasets available in a structured, query-friendly but very flexible format. [22]

[18] Refer to https://www.opendatasoft.com/a-comprehensive-list-of-all-open-data-portals-around-the-world/ for a very comprehensive list of open data portals.

[19] Refer to https://movement.uber.com. Uber has offered to make the detailed datasets available to local city governments for traffic analysis. *"It's crucial we make use of technology and data to improve the way our cities move and the way we plan our cities into the future. If we don't, we won't move quickly enough to address the needs of urbanisation"* (Alon Lits, Uber's sub-Saharan Africa GM), https://techcentral.co.za/uber-movement-traffic-data-website-launched-sa/77162/

[20] This valuable hospital database is now available as an (academic) open dataset from https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/JTL9VY

[21] University of Cape Town (2018, March 17) *"University of Cape Town Research Data Management Policy"*. Available from http://www.uct.ac.za/sites/default/files/image_tool/images/328/about/policies/TGO_Policy_Research_Data_Management_2018.pdf.

[22] Refer also to Vrandecic & Krötz (2014) pp. 78-85 for the context and interesting issues.

Open Access research and Open Access research data

The phenomenon of Open Access (OA) for academic research has a longer history than open data. The OA movement grew out of a reaction to the fact that researchers, often using public funds to pursue their research, would then publish their findings with commercial, academic publishers (Springer, Elsevier, etc.) who would typically charge very high journal subscription rates to academic institutions so that other researchers wanting to access these published papers would incur a high cost. Additionally, other steps in the academic publishing process, such as reviewing and the editorial process, would also be performed *pro bono* by academics. Apart from the fact that the only stakeholder profiting monetarily from the process was the usually highly profitable publishers, the journal costs could limit the distribution and exposure of the research papers. In particular, researchers working in more resource-constrained environments (such as developing countries) would not have access. From about 2005 onwards, strong growth in OA publishing has emerged, although exact figures on the percentage of research published as OA (typically using a Creative Commons license) is hard to ascertain[23]. The Open Access movement received a huge boost from the recent EU policy requiring EU-funded research findings to be published in Open Access media[24]. This can still be done through the commercial publishers who have a special process (with attendant high publication charges[25]) for OA articles; alternatively, the research outputs can be published in online Open Access journals[26] (the Public Library of Science – PloS – being the best known) and/or repositories [27] (with arXiv as the poster child).

One of the side-effects was that these OA channels often allowed additional flexibility to include research instruments, additional resources as well as datasets alongside the research article (although this was also sometimes available with commercial publishers). Although this is not a frequent phenomenon, some researchers released their (anonymised) datasets. A number of funders and research organisations have already created policies that require OA publishing as a default, but few have called for the research data also to be made open. An example of this Open Research Data by-default policy, possibly the first of its kind in Africa, was passed by the University of Cape Town in May 2018. The policy explicitly extends the "recent emphasis on the principle of Open Access by default to data resulting from publicly -funded research". It motivates the policy by stating that *"publicly-funded research data are a public good, produced in the public interest and should be openly available free of charge to encourage extensive reuse"*; and refers to *"relevant standards and community best practice in the international context, as outlined by the International Council of Science Unions (ICSU) and CODATA"* as referenced in OECD Principles and Guidelines for Access to Research Data from Public Funding[28]. By contrast, a June 2018 study (Adrian et al, 2018) done among the 99 USA "PUSH" (Presidents United to Solve Hunger) Universities shows only 15% have explicit OA support but not a single one had a demonstrable open data policy.

An example of the immense investment in some of the academic datasets, and their potential usefulness to scholars, is the just-published research

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[23] Apart from access costs, another driving force behind OA is an increased emphasis on replicability of results.

[24] This applied initially to projects funded at the European level through the 7th Framework Programme (FP7) and Horizon 2020. Refer to the 2013 Open Access Policy factsheet on https://ec.europa.eu/programmes/horizon2020/sites/horizon2020/files/FactSheet_Open_Access.pdf "Plan S" proposes to extend this to recipients of grants from a dozen European national funding agencies (https://physicstoday.scitation.org/do/10.1063/PT.6.2.20181011a/full/)

[25] Which makes publishing using this route unaffordable for most developing country authors. Some funding agencies allocate additional budget specifically for this; but for unfunded researchers, especially those from resource-poor institutions, this becomes an additional disadvantage and just serves to skew the low visibility of developing country research even further.

[26] The Directory of Open Access Journals (DOAJ) lists about 10,000 journals.

[27] The Registry of Open Access Repositories (ROAR) lists just under 5,000 institutional repositories.

[28] http://www.oecd.org/sti/sci-tech/38500813.pdf.

on access to emergency hospital care provided by the public sector in sub-Saharan Africa. Ouma *et al* (2018) undertook a geocoded inventory and spatial analysis. Their research found that 29% of SSA's population lived more than the 2 hours WHO threshold away from the nearest hospital. In order to do their research, the researchers painstakingly built an invaluable database of hospitals and geotagged approximately half of the 5000 SSA public hospitals in the database manually using Google Maps and OpenStreetMap data. Thankfully, this geotagged hospital database covering 44 SSA countries is now available as an (academic) open dataset to use in conjunction with any other health or population database, surpassing anything that any national or supra-national data portal has.

Using or opening up private or corporate data for the public good

Arguably, the private sector holds data with a potential impact many times that of government data. Retailers, financial organisations, telecommunications companies, social network providers and other online platforms (such as search engines) hold much bigger, diverse and deeper datasets. Indeed, many of these are referred to as 'Big Data', requiring different data analysis tools and skills, whose potential for public good is seemingly unlimited. This has not gone unnoticed and thus *"a 'responsible data' movement has evolved to discuss guidelines and frameworks that will establish ethical principles for data sharing. However, this movement is not gaining traction with those who hold the highest-value data, particularly mobile network operators who are proving reluctant to make data collected in low- and middle-income countries accessible through intermediaries"* (Taylor, 2016, p.1). The use of corporate data has also come under the spotlight in the recent developments where social media data has been used for misinformation, electoral influence or even to incite ethnic violence; the social media companies are now being forced to respond to policymakers' concerns.

Data Philanthropy

A traditional solution for the few large corporates willing to open up their private and strategically important data for the social good, was to provide a *"sandbox"* environment, i.e. allow highly restricted access by pre-qualified and trusted outside data analysts/researchers in a carefully controlled space and check findings for confidentiality or privacy issues. In very rare cases, limited datasets with micro-data were carefully anonymised and made available openly to a wider research community.

Orange's *"D4D challenge"* using real CDR data (mobile phone Call Detail Records) from Côte d'Ivoire and Senegal is a shining and laudable but all-too-rare example[29]. For instance, the D4D Challenge for Senegal demonstrated how CDR could be used in the following sectors: agriculture (4 use cases), energy (1), health (12), national statistics (9), transportation & urbanization (22) and eight other use cases. This practice is known as data philanthropy, although data philanthropy usually also encompasses the practical and technical support needed for the data analysis[30]. The emergent phenomenon of data philanthropy is currently under-researched – and under-practised. Indeed, a recent exploratory survey among some South African big data owning companies revealed a complete lack of awareness, and only a very tentative willingness to engage in data philanthropy (Mzuku & Van Belle, 2018).

Open Algorithms

A promising new angle on the traditional *"sandbox"* version of data philanthropy is represented by the Open Algorithms (OPAL) project: OPAL is *"a socio-technological innovation to leverage private sector data for public-good purposes by 'sending the code to the data' in a privacy-preserving, predictable, participatory, scalable and sustainable manner"* (Pentland & Letouze, 2017, p.1).

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[29] Orange (n.d.) "Data for Development Challenge Senegal - Book of Abstracts: Posters" provides one-page summaries on each of the 53 researcher-driven CDR use-cases.

[30] See for instance Uber's willingness to make its traffic ("Uber Movement") data available to selected cities. Although other platforms have explored limited data philanthropy initiatives e.g. LinkedIn, Facebook, Google, on the whole there appears to be quite a resistance to this. Refer to Mzuku & Van Belle (2018) or the slightly more dated https://www.unglobalpulse.org/data-philanthropy-where-are-we-now for some more background.

In other words, instead of giving access to datasets, researchers provide the data analysis code which is validated and run inside the firewalled private data centre under the full control of the data sponsors. Encouragingly, the OPAL project has just kicked off with pilot studies in Senegal and Colombia. The longer-term vision is *"for OPAL to help monitor some of the 17 Sustainable Development Goals and their 169 targets and contribute to better policies. Finer grained analysis may be monetised under a freemium model to be defined over time."* A somewhat similar version of this idea, under the banner "leveraging algorithms for positive disruption", was advanced by the Data-Pop Alliance in 2016 but focussing on "open algorithms" for National Statistics Offices (Letouze & Sangokoya, 2015).

The debate using private data for public good and the possibility of a 'data-tax'.

A longer-term, and much more politically sensitive but morally imperative debate is necessary to explore the philosophical and ethical aspects of access to, if not part-ownership of, private data which can be used for the public good. Is it morally justifiable that data generated by or about users who lack the most basic resources in the world's poorest countries, is locked up in the data centres of Silicon Valley corporations who claim full and exclusive ownership and do not allow access to national governments or NGOs trying to exploit the data for socio-economic development and upliftment? Interestingly, this debate had already played out in the public when the media decried why big data from CDRs had *not* been used for tracking the origin and spread of Ebola (McDonald, 2016). This rather "unfairly demonstrate[ed] how widely they had become seen as a potential magic bullet for emergencies and epidemics. It was implied that access was being restricted only by an oversensitivity to privacy considerations which were far outweighed by the potential good of the data" (Taylor, 2016, p.6). To put it in more polemic terms:

An isolated African community could suddenly start googling, SMSing, tweeting, or Facebooking their Zika or Ebola symptoms, while local health officials remain completely unaware of the outbreak of a new epidemic. All this just because the messages (data) are locked up behind the firewall of the Silicon Valley platform company that 'owns' their data. However, if the same people were to message about bombing their local US embassy, it is likely that the CIA would find out immediately.

Currently, the intellectual property debate seems to have been settled on terms dictated by a Western perspective which, it may be argued, seem contrary to more social or community-oriented views (such as Ubuntu) prevalent in more traditional societies[31]. This point is not raised to demand a stronger data philanthropy drive, but a call to arms to moral philosophers, humanists and legalists, particularly within African societies, to re-visit the very principles of intellectual property rights on data, by taking into account an objective but more holistic and systemic view of the originators, creators, curators, users and uses of data with the aim of a morally just allocation of the rights to all stakeholders in the value chain of this data.

What can be broadly described as the purist capitalist (or "Silicon Valley") view is that the data belongs exclusively to whoever collects the data, i.e. the platform. More social views would accord equal rights to the individual about whom the data was collected, as promulgated in more recent EU privacy laws and regulations, in particular the EU General Data Protection Regulation (GDPR). The lead author argues[32] that, given that in many traditional societies the welfare of the community trumps that of the individual, there is both a conceptual and a moral case to be made to allow the use of data for the benefit and upliftment of a community (local, regional or national) especially in cases where it does not detract from the commercial interests of the data collector (Taylor, 2016). In effect, this could be conceptualized to be an ***in-kind "data-tax".***

[31] This is analogous, although not identical, to the ongoing debate about who owns indigenous knowledge: should pharmaceutical companies that isolate the active ingredients of traditional herbal remedies be allowed to patent the resultant medication without recompense to the communities who discovered the herbal remedies in the first place? Limiting private ownership for the social good has many precedents, including the "Everyman's right" allowing Finnish people to pick berries or mushrooms on private land, or the more general "Access right" across Scandinavia allowing one to camp on, or hike across anyone's woods or mountains, as long as the owners aren't disturbed.

[32] This view is not necessarily shared by the other authors and is not the official view of the sponsoring/affiliated organisations.

What is being proposed here is that a debate is started around the notion of an 'in-kind[33] data tax': the mandated access to or sharing of data collected from a community by a private institution to use for the social benefit of that community through a designated, trusted authority. The principle underlying normal (individual and corporate) taxes is to appropriate a fraction of the taxable entity's resources in order to fund the government so it can provide (infrastructure, social, security, legal, …) services that allow the individual or corporate to live and operate in a stable and well-functioning society. This principle of giving up a share of one's private resources for the public good has been extended in other context, ranging from compulsory individual military service for national security to the required provision of production and employment data to national statistics offices, telecommunication companies that are subpoenaed to provide CDR data in criminal cases, or financial organisations need to report individual transactions for income tax purposes. Unlike financial taxes, the marginal cost of such envisaged data tax to the enterprises would be negligible whereas the social benefits are potentially (but not automatically) huge[34] .

The reluctance of many of big data-holding companies to engage with the issue of sharing their data for the use of the social good at this stage, may potentially trigger a more extreme nationalist response in governments who decide not to play by the (GATT) 'rules', as witnessed e.g. in China's dealing with the global technology platform companies[35] or, more recently in Nigeria's engagement with MTN's operational and financial affairs[36] . But, in fact, this is also becoming an issue in mainstream democracies, such as France, where the push-back by governments against the absolute corporate control of their citizens' data has recently become known as **data sovereignty:** *"a country's push to regain control over their own and their citizens' data"* to avoid becoming 'digital colonies'[37].

Data collaboratives and data stewardship.

An exciting and recent evolution in the thinking around the opening up of private data is the concept of data collaboratives: structures where organisations provide access to their data through carefully controlled and trusted mechanisms to civil society, government, researchers and similar agents with the public interest at heart. These structures are still very nascent and a variety of models are being explored. Data stewardship has been identified as being crucial to the success of these collaboratives: the individual or group tasked to identify, engage with and govern these collaborative opportunities. The data stewards act to engage both the outside partners and internal players, assess the risk and value of the data and 'nurture' the sustainability of the data collaboratives (Verhulst, 2018a). GovLab is pioneering and researching a number of case studies in this space, and busy building a network of data stewards across the globe.

Other local and regional players

There are many other stakeholders in the open data ecosystem. In particular, local NGOs often also provide datasets. On the demand side, users of open data include government officials, data journalists, corporate business decision makers, academics, citizens, NGOs, supra-national organisations, entrepreneurs, activists and any constellation of these as intermediaries. These have been discussed in more detail in the 2016 ADRR which makes a more exhaustive study of the data users and intermediaries in the data ecosystems. The users will, in any case, feature prominently in this report in the various impact case studies.

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[33] The "data tax" proposed here is not a financial tax, such as the one proposed and argued eloquently by Facebook co-founder Chris Hughes in his article "The wealth of our collective data should belong to all of us" (https://www.theguardian.com/commentisfree/2018/apr/27/chris-hughes-facebook-google-data-tax-regulation) or by German chancellor Angela Merkel, echoing a view held within the EU administration (https://www.dw.com/en/taxes-coming-to-big-data-in-germany/a-43972540). Rather it is meant to be a regulated or enforced version of the data philanthropy, open algorithms or data stewardship *"access-to-date-for-social-good-purposes"* concept.

[34] However, any such practical implementation would require a huge trust in the competency of a relevant authority to assure security, privacy, data governance and protection of competitive advantage. Admittedly, few African government agencies currently could instil such trust, barring some NSOs. But the mechanisms described here of open algorithms or data stewardship could provide a possible avenue.

[35] Although the official reason for blocking Google, Facebook or Twitter access to China in censorship, national access to private user data is a major factor in these debates. See e.g. https://www.scmp.com/comment/insight-opinion/united-states/article/2164277/what-next-facebook-and-google-if-they-dont or https://www.reuters.com/article/us-facebook-privacy-congress/facebook-confirms-data-sharing-with-chinese-companies-idUSKCN1J11TY

[36] https://www.bloomberg.com/news/articles/2018-08-29/nigeria-orders-mtn-banks-to-refund-8-billion-exported-funds

[37] The French government and military have just decided to replace Google's search with Qwant, a French/German search engine that does not track user data: https://www.wired.co.uk/article/google-france-silicon-valley . It is also interesting to see former colonial empires now being fearful of becoming 'digital colonies' themselves.

5 OPEN DATA PUBLICATION OF CORE DATASETS IN AFRICA: FINDINGS FROM THE AFRICA OPEN DATA INDEX

The more representative and comparative mapping of the status and development of open data in Africa can be derived from two major global initiatives in this space: the Africa Open Data Index (AODI) by Open Knowledge International, and the Open Data Barometer (ODB) by the World Wide Web Foundation. The ODB reports how governments around the world are publishing open data, particularly in respect of readiness for open data initiatives and impact that open data is having on business, politics and civil society. The AODI looks at 15 core datasets to determine to what extent this data is available. This section details the findings from the AODI. The next section will discuss the ODB.

Data collectors and publishers

Due to a lack of information on government agency websites, it may be hard to understand which government agency is producing or holding certain data. In many cases this information needed to be derived from institutional documents, and secondary literature on public sector governance. Administrative and legal data can be usually found on government websites. Other data, including land ownership, infrastructure, and environmental data was more frequently found via secondary sources such as market analysis websites (in the case of energy data), sectoral assessments such as World Bank's Land Governance Assessment Framework and EITI reports, or websites of data platforms (such as the databases of Trimble in the case of mining concessions). NSOs are important central access points to a variety of statistics, including national figures on energy provision and energy markets, as well as environmental statistics.

Data provenance must be improved to indicate which data can be clearly considered authoritative. For instance, the data available via the Africa Information Highway portal may host more than official national data. Tanzania's National Bureau of Statistics publishes geographic information (administrative boundaries and markings of water stretches) as part of census data, but our researchers were unable to find data source attributions. On other occasions, governments publish data from

a large survey such as UNICEF's Multiple Indicator Cluster Survey, as done by Somalia's Statistics Office[38].

The AODI survey also sheds light on some of the activities of non-domestic, often international, organisations providing data. Besides common cases such as USAID's Demography and Health Surveys, UNICEF's Multiple Indicator Cluster Surveys, or FAO's statistics on agriculture, some sectors were particularly striking. Data on extractive industries is primarily provided by the company Trimble whose data portals are used by 15 African governments to publish data on mining concession, including geographic boundaries, the type of concession, the licensee, contract start and duration and size of territory. This data is provided in partnership with the Extractives Industries Transparency Initiative and national ministries, yet completeness of data differs across portals. Thanks to the African Legal Information Institute (AfricanLII)[39], a programme of the Democratic Governance and Rights Unit at the Department of Public Law at the University of Cape Town, there are alternative sources of national legal code for many countries. AfricanLII and its associated websites compile legal code in several countries. Educational data is - if not provided by governments - provided by organisations like UNICEF, NationMaster, the Global Partnership for Education, or the World Bank.

Environmental data on deforestation is sometimes provided through the assistance of programs like REDD+, or the Congo Basin Forest Atlases provided by the World Resources Institute (WRI) and USAID for the Democratic Republic of the Congo. WRI partners with the Ministry of Environment & Sustainable Development (MEDD) to develop the Interactive Forest Atlas of the Democratic Republic of Congo and build the capacity of forest stakeholders in remote sensing, GIS, and forest information management. Overall, environmental data remains one of the least commonly provided data groups, with air pollution and water quality data being particularly rarely produced beyond smaller administrative zones.

Completeness

Roughly one fourth (23%) of all datasets are not available online at all. For the remainder of cases, at least one of the required data points could be found online.

Budget data is provided in varying quality, ranging from entire copies of the budget data, with more than one hundred pages of data (Chad- Budget) to general descriptions of proposed budgets. Budgets are either published as budget figures or finance law. It seems that more detailed budgets are available in countries that receive aid for specific topics like SDG achievements (see the example of Nigeria). Some governments only make the proposed budgets or reports available, but not the enacted budget. Commonly provided **procurement information** includes contracts and the amount awarded, yet often tenders are not associated with this information. Some countries publish more complete data, but may only cover a few months before publication ends (see Madagascar and Namibia). Inconsistencies in publication frequency or sudden stops in publication were noticed. Most data is only available as HTML tables, with PDF descriptions of the tenders. In other cases, the government publishes a magazine or similar for the open tenders (see also Branduscescu & Nwakanma, 2017).

Commonly, **company registers** use search engines requiring users to know company names or other identifiers. Some governments provide continually updated list of company registrations; other governments only make company information available for other companies. Some governments indicate the CEO or executing manager of a company, but it was not possible to understand company ownership (defined as financial ownership (e.g. shareholders) or influence on a company). Sometimes governments do not indicate how many companies are included in a register, making it hard to assess if the registers are complete.

Land ownership information on natural resources is only available for mining cadastres. Cadastral

[38] http://www.dns.org.so/microdata/index.php/catalog/3/study-description . Especially where these surveys, like MICS, are run by the local NSOs.

[39] https://africanlii.org/. Country sections of this program include https://ghalii.org/, http://kenyalaw.org/kl/, https://malawilii.org/, https://namiblii.org/, https://nigerialii.org/, https://sierralii.org/, http://www.saflii.org/, https://tanzanialii.org/, https://ulii.org/

systems sometimes underwent recent land reforms or are being planned (for example in Tanzania[40]), in the process of being mapped, or digitised. In addition, cadastral information may be governed by local authorities, and it could not be verified to what extent surveys and other agencies hold central records of which parts consist of land administration information. Governments publish mining cadastres online; one country also publishes a forest cadaster. Information on mining concession recipients is available in some cases.

National laws were usually found on parliamentary websites showing a list of draft or ratified legislation, typically grouped by year. A few countries provide consolidated legislation including contents of laws with all amendments consolidated, but this is not the norm.

Among **national statistics,** vital statistics are often not provided by statistics offices, but a bureau of civil registrations and are missing in several countries despite several articles indicating that governments and civil society implemented these measurements. In some cases, vital statistics indicators are extrapolations from population censuses and as such not reflecting an actual register.

Educational statistics are often provided as part of censuses, and household surveys published by education departments or ministries and are sometimes published as part of statistical yearbooks. Sometimes education management information systems (EMIS) statistics are provided which typically cover all the required indicators. Literacy rates are typically included in census or household survey data and are therefore not always updated. Exam results are mostly always available as aggregated results statistics.

Gender-focused statistics surveys are in many cases done in collaboration with, or funded by UN-Women.

Election results are provided by electoral commissions. In a few cases, no official election results are published. Yet, unofficial figures on election results could be found in all countries. Most commissions cover the majority of indicators (results, disaggregation by district). Less commonly published data includes voter registrations and locations of voting stations.

Agriculture data such as crop yield and prices are usually made available as statistics, as part of statistical yearbooks. Weather time series data by the national meteorological institutes are usually published as PDF reports, yet are less often provided.

Health statistics are mainly available as PDF reports. USAID's Demography and Health Survey offers an alternative source for health data after registration.

Geographic information was difficult to access. Generally, it was not difficult to find official statements regarding the institution which is responsible for geodata, yet evidence that data exists was problematic to gather. Often map sheet plans serve as proof, such as in Algeria[41] . These plans show which regions are mapped and in what data format they are available. Besides geographic and land ownership data, environmental data is least commonly provided. Extractives activities are provided by approximately half of all countries and are provided by the Trimble platform as part of a country's EITI commitments. This information includes the geographic location of the concession, concession start date, duration of concession, concession status. Monitoring data, such as air or water pollution levels are rarely collected, yet initiatives on local administrative levels exist to start collecting data.

[40] See Office de la Topographie et du Cadastre, http://www.otc.nat.tn/index.php/projets/geoportail-cadastral
[41] http://www.inct.mdn.dz/site%20anglais/web_inct_sim/prd-topographique.php

Table 2: Percentage of African countries providing the indicated datasets.

Data category	Availability of data points [42] (percentage of countries providing respective data-points
Agricultural data	Crop yield: 80% Crop prices: 50% Weather conditions: 27% Soil properties: 7% **No data online: 17%**
Budget	Enacted budget: 90% Ongoing revenues: 83% Disaggregated by ministry: 83% **No data online: 3%**
Companies	Company name: 66% Location: 47% Unique ID: 47% Date of registration: 40% Available for entire country: 33% **No data online: 33%**
Education statistics	Enrolment and completion rates: 67% Data for 2/more school stages: 63% Disaggregation by sex: 60% Attendance and literacy rates: 50% Exam results: 33% **No data online: 20%**
Elections	Election results: 53% These countries provide results disaggregated by constituency/district. Figures of registered votes: 47% Invalid votes: 40% **No data online: 40%**
Environmental data	Extractives activities: 47% Deforestation: 23% Air pollution: 20% Water quality: 13% **No data online: 30%**
Gender	Data on violence against women: 73% Data on women in management positions: 50% **No data online: 13%**
Health	Immunization rates: 73% Fertility rate: 70% Infant mortality rate: 70% Mortality rate: 60% Disaggregation by sex/age: 56% Over-/ underweight rate: 43% Stunting rate: 37% **No data online: 7%**

[42] In percentage of all 30 countries analysed.

Data category	Availability of data points [42] (percentage of countries providing respective data-points
Infrastructure	Electricity consumption: 73% Prices: 60% Power stations and electric capacity: 60% Electricity transmission networks (geographic position): 37% Water consumption: 27% Power outages: 20% **No data online: 10%**
Land ownership information on natural resources[43]	Parcel boundaries: 30% Parcel location: 30% Available for the country: 23% Different cadastre types: 3% **No data online: 67%**
Law	The content of law: 80% Date of last amendment: 63% Amendments: 33% **No data online: 20%**
National maps	National borders: 60% Administrative boundaries coordinates: 60% Admin. Boundaries level 2: 60% The scale of 1:250.000: 54% Water stretches: 47% Markings of national infrastructure: 43% Markings of relief/heights: 43% **No data online: 40%**
Procurement	Tender name & description: 93% Supplier's name: 73% Tender status: 70% Award announcement: 70% Value of the award: 70% Available per national government office: 53% **No data online: 7%**
National statistics	Consumer Price Index: 90% National population census: 80% Gross Domestic Product: 77% Trade statistics of import and export: 70% National employment rate: 63% Birth and death statistics: 23% Foreign Direct Investment: 17% Foreign aid: 13% **No data online: 6%**

[43] **Important: This assessment only refers to mining cadastres**. Only Cameroon also publishes a forest cadastre alongside a mining cadastre. We have not found countries publishing cadastral data or land ownership data for cities or rural areas.

Timeliness

One-third of all the assessed data is provided in a timely manner. The AODI assessed whether timely data is provided by governments, if the data is useful and if governments have stable data publication processes in place. To assess timely publication, our research considered whether governments publish data in a particular timeframe, depending on how often we can expect data to be updated.

Stark differences were found across individual data categories and countries. Some countries provide timestamps in their data indicating what time span the data refers; other countries added notes about when the data was last updated. Yet, this is not always the case and inhibits understanding of the extent to which data is up-to-date. The following section describes how many governments update each data category[44]. Roughly three out of four countries publish budgets (80% of the countries sampled), national laws (73% of all countries) and procurement information (70% of all countries) that is not older than one year. Half of all countries publish updated elections data and 47% keep their company registers updated.

All other data categories are updated by a small percentage of the assessed countries. The majority of countries do not provide updated statistical information. One reason may be the way statistical information is provided (for example as part of costly household surveys). Land ownership data is updated by 26% of countries; environmental statistics and infrastructural data by 23%; sex-disaggregated data and health statistics by 13%; national statistics, education statistics, national maps by 10%, and agricultural data by only one country.

These findings should be interpreted as trends for the following reasons: some data categories include considerably more and diverse data points, such as agricultural data including weather forecasts. Other data categories refer to one piece of information only (for example budgets) and measure its availability. If a country did not provide timestamps and metadata, the data was considered to be outdated, as the researchers were unable to prove the contrary.

Open licensing and machine-readability

Only 6% of all data (28 out of 420 datasets) is openly licensed, that complies with the criteria laid out by the Open Definition. According to its nine requirements for legal openness[45], open licenses must allow anyone to use data for any purpose. Restrictions may only regard provenances, such as attribution of contributors, rights holders, sponsors, and creators, and possibly restrictions in that adapted artifacts must conform to license terms similar to the works from which they originated. Publishers must comply with these requirements in order to open up their information. Open license terms are used by Statistical offices in Botswana, Senegal, Rwanda, and Somalia, as well as open data portals in Cote d'Ivoire, Eritrea and Kenya and Mauritius. Among these licenses are bespoke license terms compliant with the Open Definition as well as in some cases Creative Commons Attribution license[46]. This small number of datasets (28) does not show a trend for a particular type of data being more often openly licensed than another. Usually, no license terms are provided for websites, other than copyright notes. 14.5% of all data (61 datasets) is provided in at least one machine-readable format. The usual ways of publishing data are via websites (embedded in HTML, or provided as images), or in PDFs.

[44] Note that the data does not have to be completely published to count as updated, but in case governments publish different pieces of information, these have to be the latest available version in order for the category to count as updated.

[45] http://opendefinition.org/od/2.1/en/

[46] https://creativecommons.org/licenses/by/4.0/

Recommendations

On the basis of our findings we suggest that governments in Africa can improve the provision of open data as follows:

Make data findable, accessible and usable

- **Clearly communicate the data you hold:** Clearly communicate on your websites what data your agency is collecting about different government activities and which of this data is open to the public or can be requested.
- **Prioritise data to publish:** Before making investment choices in open data, identify which data should be priority areas to publish first. Data publication should be prioritised in multi-stakeholder processes, including representatives of civil society and the private sector.
- **Make data permanently accessible and findable:** Data should be made available at a permanent internet location and in a stable data format for as long as possible. Avoid broken links. Provide links to the data whenever you publish data elsewhere (for example via a statistical agency).
- **Add metadata to ensure that data can be understood by citizens and found via search engines:** Add metadata to describe your dataset, the data producers (the origin of data), explanations about data points, and update frequency. Metadata should be machine-readable, easily findable and link to a data source.
- **Provide data in machine-readable formats:** Ensure that data is processable. Raw data must be published in machine-readable formats, which need to have consistent values.

Use open licenses

- **Determine the legal context first:** Clarify if the data falls under the scope of copyright, or similar rights. If information is in the public domain, apply legally non-binding notices to your data.
- **Use standard open licenses:** Use CC0 for public domain dedication or standardized open licenses, preferably CC BY 4.0. They can be reused by anyone, which helps ensure compatibility with other datasets.
- **Avoid confusion around license terms:** Attach the license clearly to the information to which it applies. Clearly separate a website's terms and conditions from the terms of open licenses. Maintain stable links to licenses so that users can always access license terms.
- **Use custom open licenses carefully, and only if needed:** If you opt for a custom open license, ensure compatibility with the Open Definition. It is strongly recommended to submit the license for approval under the Open Definition.

THE OPEN DATA BAROMETER– AFRICA EDITION 2018: OPEN DATA READINESS, USE AND IMPACT IN AFRICA

6

The Open Data Barometer – African Edition aims to uncover the true prevalence and impact of open data initiatives in the African continent. It analyses regional trends, and provides comparative data on governments and countries using an in-depth methodology. Covering 29 countries[47] in this special African Edition for the Africa Data Revolution Report, the Barometer ranks governments on their readiness for open data initiatives, as well as the use and impact that open data is having on business, politics and civil society.

This chapter is only intended to be a summary of the most striking findings in the African Open Data Barometer research. The full data and methodology are available online[48], in order to support further secondary research and inform better decisions into the progression of open data policies and practices in the continent. A brief summary of the methodology was given in *Section 3*.

General research findings

As a first conclusion, progress in the African continent is slow overall. While some governments are advancing towards data openness, that remains the exception, not the rule. East and West regions in the African Union are most advanced, followed closely by the South. Many countries in North Africa have fairly strong commitments but are lacking almost all other elements necessary for success. Lastly, the Central region is clearly falling behind all others on almost every single indicator in the analysis.

[47] The countries covered are: Algeria, Angola, Benin, Botswana, Burkina Faso, Cameroon, Chad, Côte d'Ivoire, Congo, Egypt, Ethiopia, Ghana, Kenya, Madagascar, Malawi, Mauritius, Morocco, Mozambique, Namibia, Nigeria, Rwanda, Senegal, Sierra Leone, Somalia, South Africa, Tanzania, Togo, Tunisia and Uganda.

[48] The Africa Open Data Barometer 2018 methodology can be accessed at https://docs.google.com/document/d/1SW9RUbgbVHCqCD-Hd5TbT_DYQ8TwwryKblc4cBLBwXY/edit?usp=sharing, and the database at https://drive.google.com/file/d/1Jf4NdLAZm3yzkgM7bA7JzZIH6FS3aGZ9/view?usp=sharing

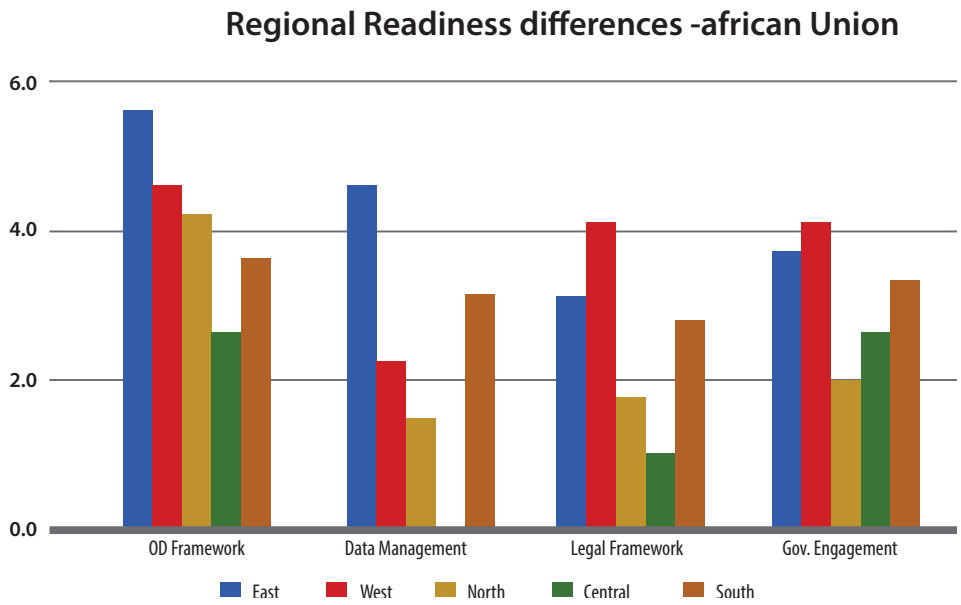

Figure 2: Comparison on open data readiness among the different African Union region

Most governments still lack any kind of comprehensive guidelines, technical standards, and management procedures for their (open) data. Government-wide strategies or policies are too often only considered once open data initiatives have already been in place for some time. This is not only happening in Africa. It is a global issue also found in all other world regions — including the most advanced countries. Open data is not yet entrenched in law in the continent, and the legal frameworks supporting it are either incomplete or directly absent. Implementation and resourcing are also very weak.

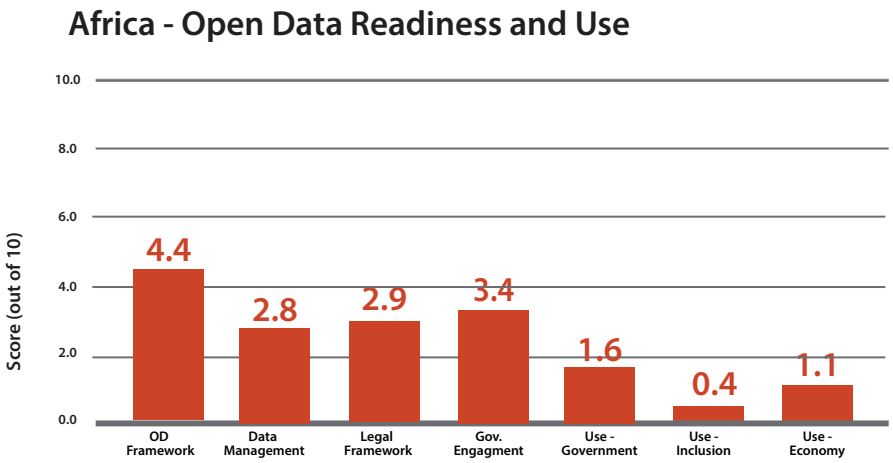

Figure 3: Average open data readiness and use scores for Africa

Additionally, no stand-out performer could be found in Africa. This makes Africa the only global region without a clear local open data champion. Ghana, Kenya, Nigeria, South Africa, Tanzania and Burkina Faso all looked ready to assume such role at some point in recent years, but ultimately the data shows that the performance of these countries has been erratic over time. A possible reason for this is that governments in the region usually require external support to start with their open data initiatives, and that support may not be aligned with the needs expressed by African governments in the long term. Governments in the continent are still too technically and financially dependent on third-parties for creating and sustaining open data initiatives.

Finally, very few open data initiatives in the continent actively promote inclusion and equity. The research found some evidence that open data is contributing to government transparency and the creation of new businesses, but little or no evidence that it is contributing to social inclusion — whether by enhancing excluded groups' access to public services or increasing their participation in policy decisions.

The following sections discuss some more detailed findings.

Open Government Data initiatives in Africa

Governments need to develop teams, strategies, action plans and policies in support of their commitments to open data. Strategies will typically be high-level plans focused on the particular long-term goals, actions and resources required for success, while action plans and policies will define specific courses of action adopted to guide decisions towards implementation.

Governments in Africa frequently have commitments to increase government transparency and release open data, but that these commitments are usually vague and lack high-level political backing. Countries that are Open Government Partnership (OGP) participants[49], such as Morocco and South Africa, usually connect their open data commitments with their national OGP action plans. For other countries, such as Sierra Leone[50] , their only reference is the World Bank Open Data Readiness Assessments (ODRA). However, there is almost no evidence of any documented national open data policies or strategies that articulate processes, responsibilities and timelines in the continent. Those few that are available have usually been in a draft stage for years and were never officially published, promoted, endorsed or formally adopted. Such is the case of Nigeria[51], Rwanda[52], Tanzania[53] or Uganda[54], for example. Others like Ethiopia[55] are currently developing their strategies.

The number of governments in the region releasing their national data catalogues keeps increasing, with eight out of every 10 countries maintaining a reference catalogue of some kind. However, sometimes governments do not remain in control of their own data portals when third-party providers or other external partners manage them, such as in the case of the Open Data for Africa repositories[56]. In such cases, when external support for the data portal management ends, there is a high probability that the portal will die. Nevertheless, data portals from National Statistics Offices (NSOs) remain the most frequent and reliable data sources available. Government-run open data initiatives and teams are also becoming more frequent, for instance, in Morocco, Burkina Faso and, more recently, Mauritius. Still, those rarely have the human and budgetary resources to be sustainable over the long term and are generally too dependent on external development resources from international multilateral organisations, such as the World Bank or United Nations agencies. This dependency means that in a large number of cases, open data initiatives are discontinued when external resources are no longer available. That has been the case for Ghana on two occasions, and also in Kenya.

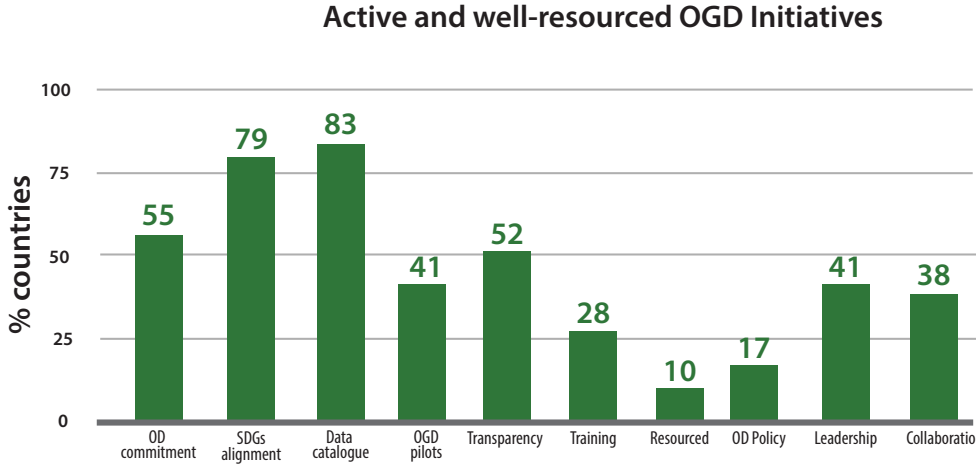

Figure 4: Percentage of countries fulfilling various well-resourced OGD initiative indicators.

[49] OGP members in our study are: Burkina Faso, Côte d'Ivoire, Ghana, Kenya, Malawi, Morocco, Nigeria, Sierra Leone, South Africa and Tunisia. Tanzania withdrew in June 2017.
[50] Sierra Leone's Open Data Readiness Assessment: http://opendatatoolkit.worldbank.org/docs/odra/odra_sierra_leone.pdf
[51] Nigeria's Draft Open Data Guidelines: https://docs.google.com/document/d/1Ssbsj-eTEVUcFITnus-hPMFjTgkHQT_Sypbb8UCGQLk/edit
[52] Rwanda's Open Data Policy Draft: https://web.archive.org/web/20160314041200/http://www.myict.gov.rw/fileadmin/Documents/Policies/Rwanda_Open_Data_Policy-Draft.pdf
[53] Tanzania's Open Data Policy Draft: http://www.nbs.go.tz/nbstz/documents/Open%20Data/Open%20Data%20Policy%20draft%20Final%20final.pdf
[54] Uganda's Open Data Policy Draft: https://ict.go.ug/2018/06/17/open-data-policy-draft-may-2017/
[55] Ethiopia's National Open Data Policy Draft: http://www.ethiopia.gov.et/documents/20181/23610/Draft+Open+Data+Policy+and+Guideline/5060aba1-2ce4-4a51-9265-3945c1f5df88
[56] http://dataportal.opendataforafrica.org/

One can also start to find some small-scale sectoral pilot programmes by different government agencies to promote the release of government data online. The most frequent are the Extractives Industry Transparency Initiative (EITI) — where almost a half of countries implementing the standard are in Africa[57] — and budget transparency projects, such as in Tunisia[58] . Our research also finds frequent alignment (8 out of every 10 countries) between the national development plans and the Global Sustainable Development Goals (SDGs) — which could contribute to better data policies and practices in the medium term. However, that alignment is happening at different levels, with some countries trying to map their existing development plans to the SDGs while others have actively built their plans in alignment with them.

Interestingly, the research also found that when governments want to exchange experiences and technical expertise with other countries or organizations, the absence of clear references in the continent means they generally go to international forums such as the Open Government Partnership (OGP), the International Open Data Charter, or the Global Open Data for Agriculture and Nutrition network (GODAN).

Data management and publication approach

When releasing data, regardless of whether they could be considered strictly open or not, this should be done in a uniform way across all agencies and departments to help people to use them. Data also needs to be fully described, as appropriate, to help users to fully understand them.

The research shows that countries in Africa typically lack even minimal narrative descriptions of published data (present in only one third of the countries studied). Very basic core metadata elements are relatively frequent (two thirds of the countries), usually including *dataset names, formats, and publication* and *update dates*. However, such metadata is not standardised across government, and machine-readable metadata is scarce (40%). Single and exhaustive (open) data inventories are not present in any government agency. The alternatives for available data formatting options are very limited as well, with PDF documents and XLS(X) spreadsheets being by far the most common.

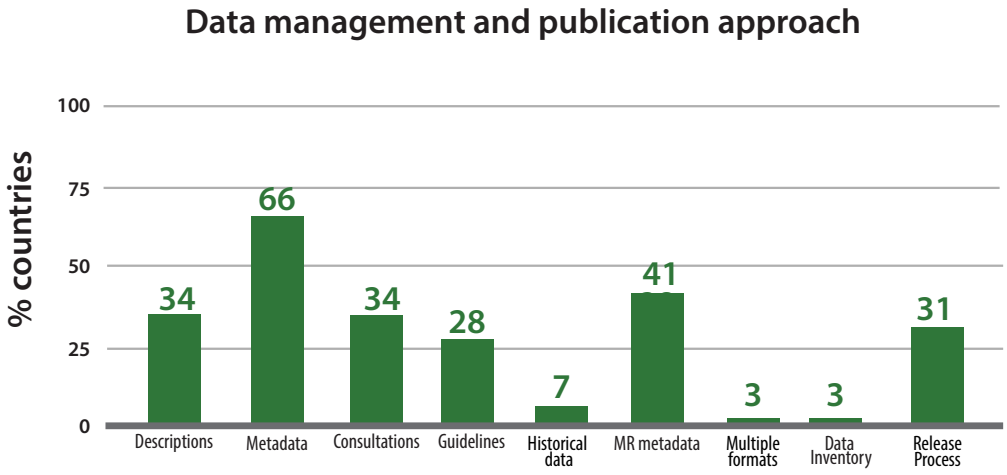

Figure 5: Percentage of countries fulfilling various data management and publication indicators.

In general, it can be said that there are no public data guidelines and standards for the publication of (open) government data, with the only exceptions coming from National Statistics Offices. We found that NSOs are the only bodies that apply consistent information lifecycle management practices, ensuring that data is being kept regularly updated. In a couple of cases — in Algeria and Ethiopia — even historical copies of datasets are preserved.

When public consultations on user's data needs and preferences are conducted, those are usually done using very basic online feedback systems where it is not clear if requests are actually being addressed. Nevertheless, we did find some more interactive approaches, such as in the case of Tanzania or Rwanda, where governments have been requesting more direct feedback at collaborative workshops.

[57] https://eiti.org/countries
[58] Tunisia's Open Budget Portal: http://www.mizaniatouna.gov.tn/tunisia/template_fr/index.html

Legal framework: data protection and right to information

Data protection and Right to Information policies and frameworks are key elements for supporting a "data openness" culture in a government. Together they can help to make more data available, while protecting individual rights to privacy. However, the research found that weak or absent data protection and right to information laws across the continent is the norm. In a number of countries, legislation has been under debate for several years, often by different governments, but ultimately never turned into law, such as the data protection bills in Kenya (2012)[59] and Uganda (2015)[60] and right to information acts in Ghana (1999)[61] and Botswana (2010)[62].

According to the research, legal or regulatory policy frameworks to promote data protection are not working well in practice. In a large number of cases these exist only in some form of general and undefined policy statements as part of the country Constitution or some national ICT and electronic communications policies. In cases where a dedicated framework is in place, several key elements that make data protection frameworks strong are usually missing — such as the right of choice and consent; the right to access and correct; or the right to redress. Furthermore, only 28% of countries have procedures to ensure data is always anonymised prior to publication — a step required to ensure sensitive, personally-identifiable data is removed.

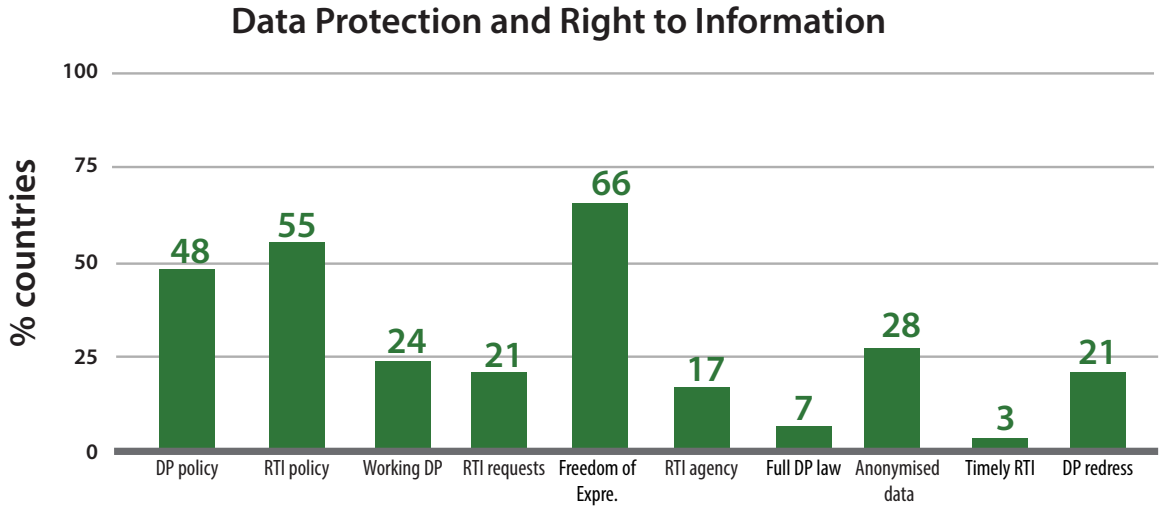

Figure 6: Percentage of countries fulfilling various data protection and right to information indicators.

Equally, strong right to information laws and frameworks are largely absent, with some exceptions such as Sierra Leone, Tunisia, South Africa, Kenya, Ethiopia and Malawi. Even in some of those cases where the legal framework is in place, they are not really "effective" — with a lack of dedicated agencies to deal with information enquiries leading to unactioned requests for information, limited recourse for cases that are refused, slow response times, and poor quality information when it is provided.

On the positive side, freedom of expression is more broadly respected[63] in our sample group of countries by protecting those who use government data and information to identify corruption or criticize governments.

[59] Kenya Data Protection Bill 2012, http://icta.go.ke/data-protection-bill-2012/
[60] Uganda Data Protection and Privacy Bill 2015, http://chapterfouruganda.com/sites/default/files/downloads/Data-Protection-and-Privacy-Bill-2015.pdf
[61] Ghana's Parliament Begins Consideration of RTI Bill, http://www.ghana.gov.gh/index.php/media-center/news/2565-parliament-begins-consideration-of-rti-bill
[62] http://www.humanrightsinitiative.org/programs/ACT/Botswana/BotswanaFOIBillPvtmmbr-prelimcritique-Mar11-Delhi-VenkatN.pdf
[63] https://freedomhouse.org/report/freedom-world-2018-table-country-scores

Government engagement with the rest of stakeholders

Effective campaigns for open data need to be composed of civil society organizations, data technologists, informational professionals, computer experts, academia and ordinary citizens who advocate for greater access to government data.

There is clearly an emergence of active civil society groups in most countries in Africa (9 of every 10) who are demanding more transparency from government: Handeka in Angola; Afrinype in Botswana; iHub in Kenya; Marocviz in Morocco; Ntatenda in Mozambique; Data Wazi in Rwanda; Tacid Network in Tunisia; Social Watch in Benin; Dataforces in Togo and dozens more — as well as other cross-country communities such as the Open Knowledge Network, Code for Africa or OpenStreetMaps, which are all very active in the continent. All these organisations are working with government data and promoting a culture of data innovation through the development of visualizations and applications and the organisation of competitions, hack days and informative sessions. Some of these organisation go one step further and are contributing to government data with original data they directly collected — for example A2K4D in Egypt; Akvo in Burkina Faso; IHI in Tanzania and OpenUp in South Africa. Moreover, international organisations such as the African Development Bank and the Red Cross also make contributions.

These activities are frequently coming from developer communities and other civil society groups with no government support at all. In the few cases where governments are directly involved (less than 20%), support is usually very limited. Furthermore, governments show few proactive efforts towards engagement with civil society on data openness, frequently only through general consultations when new data policies are being developed or when introducing new major statistical surveys. Financial or functional incentives from governments to create new services or support innovative activities such as funding schemes, incubators or open data boot camps are rare, with some remarkable exceptions to imitate by others, as for example the Tanzania Data Lab or TechMousso in Côte d'Ivoire.

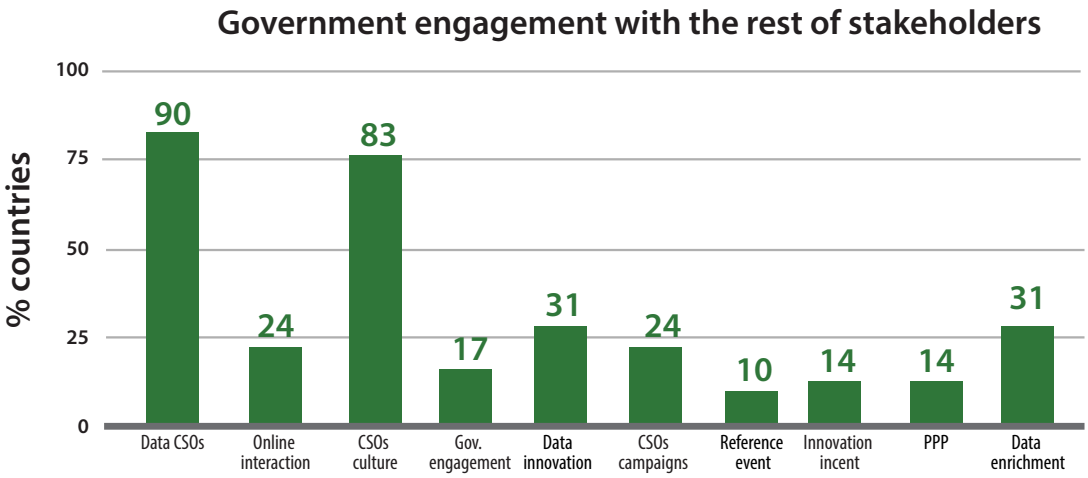

Figure 7: Percentage of countries fulfilling various government engagement indicators.

Some examples of coordinated civil society campaigns calling for more (open) government data or working with governments to promote data openness and create value could be found around different key governance fields such as elections[64] in Burkina Faso; water and sanitation[65] in South Africa; public procurement[66] in Nigeria and the Coalition for the Right to Information[67] in Tanzania.

Public-private partnerships to support the release of (open) government data and maximize impact through effective use and data collaboratives are rarely explored. The few examples found by the research typically involve other multilateral, international organisations such as the World Bank, the Open Data Institute or the United Nations.

[64] https://theodi.org/project/case-study-burkina-fasos-open-elections/
[65] http://code4sa.org/2016/04/04/hack4water-hackathon.html
[66] http://procurementmonitor.org/ppdc/category/projects/
[67] https://www.twaweza.org/go/access-to-information-act

Finally, the research also found that, in the absence of any other regular national open data events — beyond the regional African Open Data Conference and the Francophone Africa Open Data Conference — the Open Data Day[68] is playing an increasingly important role as an annual community meeting point. It serves not only as a forum for the discussion of the status of data publication and availability in the different countries, but also as community coordination and advocacy milestone. There were 80 different registered events in the African continent for 2018 — 16 of those supported by the Open Knowledge International mini-grants scheme[69] — from a total of 400 events globally. This reinforces the perception of a vibrant and promising data-driven community.

Open data use and impact in Africa

The ultimate goal of opening government data is to drive positive change in people's lives. Open data could lead to improvements in government efficiency, effectiveness, transparency and accountability. It can also lead to more inclusive policy making and government services, as well as having an impact on the economy.

However, the analysis shows that use and impact of open data in the continent is still quite limited and focused mostly on increasing government transparency and accountability, as well as fostering entrepreneurship using open data to build new businesses.

For instance, open data in Kenya helped citizens and data journalist to acquire information about government job vacancies, government tenders, and other government procedures[70]; contributed to battle Ebola outbreak[71] and promoted transparency[72] at the district level in Sierra Leone; was a key enabler of the fight against corruption[73] in Botswana; played an important role in planning, mitigation, and preparation for natural disasters [74] in Malawi; advanced transparency in the mining sector[75] and the exploitation of other natural resources[76] in Congo; demonstrated to be an efficient tool in tracking mining revenues[77] in Ghana; improved reliability and accessibility of health services[78] in Kenya and responded to the public demand of greater accountability for the school system[79] in Tanzania.

On the economic side, disclosure of government oil revenues in Nigeria uncovered vast discrepancies[80] between what the government has received and what they should have received, and doubled government's revenues from mining[81] in Ghana after revealing a very low tax regime for mining companies. A number of data-related startups and companies are also starting to flourish as data availability increases. Some examples are: Farmerline and Esoko in Ghana; Data Science in Kenya; Korbitec in South Africa; OroData in Nigeria and Eduweb in Kenya. Data journalism is another sector which is benefiting from open data. The Citizen in Tanzania and NewsPlex in Kenya are both good examples of this.

On the other hand, the use of open data for the inclusion of marginalised groups in policy making and accessing government services is undeveloped. A very few use cases could be found in the dimension, such as uncovering problems in access to clean water[82] in Burkina Faso; identifying low-income areas[83] in Kenya or raising awareness about the level of inequality[84] in Nigeria.

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[68] Open Data Day: http://opendataday.org/
[69] https://blog.okfn.org/2018/02/20/announcing-the-2018-international-open-data-day-mini-grant-winners/
[70] https://www.centreforpublicimpact.org/case-study/open-data-kenya/
[71] http://odimpact.org/case-battling-ebola-in-sierra-leone.html
[72] https://www.researchgate.net/publication/305567211_Promoting_Transparency_and_Acountability_with_District_League_Tables_in_Sierra_Leone_and_Malawi
[73] https://www.centreforpublicimpact.org/case-study/fighting-corruption-botswana/
[74] https://opendri.org/project/malawi/
[75] https://congomines.org/
[76] http://agriculture.gouv.fr/sites/minagri/files/gw_rapport_rdc_mai2015.pdf
[77] https://www.one.org/international/follow-the-money/tracking-extractives-collecting-double-the-mining-revenues/
[78] https://health.the-star.co.ke/
[79] http://odimpact.org/case-open-education-information-in-tanzania.html
[80] https://www.one.org/international/follow-the-money/auditing-whats-extracted-recovering-2-4billion-and-uncovering-revenue-losses-of-9-5b/
[81] https://www.one.org/international/follow-the-money/case-studies/tracking-extractives-collecting-double-the-mining-revenues/
[82] http://carteau.gov.bf/
[83] http://majidata.go.ke/maps-data/
[84] http://yourbudgit.com/impactreport/EvenITUp.html

The Africa Open Data Barometer recommendations

The Open Data Barometer study finds that African governments still have a long way to progress on open data readiness, use and impact. The following recommendations outline specific actions that, according to the research, could contribute to advancing the African open data agenda while addressing some of the key challenges in the region:

Build an open data knowledge network for the continent: A space where governments and all other stakeholders in the data ecosystem could regularly share and exchange experiences and technical expertise between them. Such network should also facilitate the connection and engagement with other international open data efforts — including reference open data pioneers, multilateral organisations and multi-stakeholder collaboration and advisory groups, such as the Open Data Charter or the Open Government Partnership — to ensure that the particular needs and vision from Africa are always represented in the global discussions and standards.

Ensure sustained, meaningful engagement: Greater levels of cooperation between governments, funders and civil society advocacy groups are required to initiate sustainable, long-term initiatives and projects that deliver on open data promises. Governments and civil society need to collaborate. Governments must embrace a *publishing with purpose*[85] approach, consult citizens and data intermediaries and give top priority to opening up the data that will help them get what they really want and need — better public services, more transparency, and accountability. To make open data work for people, governments need to communicate openly and take advantage of the vibrant and growing civil society community to understand what data they want and how they can use it to improve services and governance.

Let the continent take ownership of their own open data initiatives and projects: Donors need to continue providing funding, training and support for African countries in order to build internal capacity and close the data gap — not only providing initial support and assistance to get the ball rolling, but also helping developing countries to tackle and overcome long-standing barriers of low connectivity, weak data management infrastructures, poor legal foundations and scarce skills that limit open data achieving scale. In that process African governments and citizens should remain in control of their projects from the initial planning stage to the end. Any support provided should be totally aligned with the needs expressed by African governments and citizens.

The Open Data Barometer's global long-term policy recommendations[86] could also contribute to improvement as the different initiatives keep advancing on their open data journeys.

[85] https://medium.com/@opendatacharter/publishing-with-purpose-introducing-our-2018-strategy-ddbf7ab46098
[86] https://opendatabarometer.org/leadersedition/report/#policy-recommendations

ASSESSING THE IMPACT OF OPEN DATA IN AFRICA

7

Some initial considerations concerning the impact of open data

The mere release of open data does not guarantee impact; in fact, nothing is further from the truth, popular expectations or best intentions notwithstanding. *"Build it and they will come"* is wishful thinking, perhaps based on aspirational benefits over-sold by well-meaning open data advocates. The more mature the data ecosystem and more advanced the state of the knowledge economy, the more benefits typically accrue.

One of the easy traps to fall into is to focus on the low-hanging fruit, i.e. release as many 'ready' datasets as possible, forgetting that **it is not the size of the data or the number of datasets that will determine the success or impact of open data initiatives.** Rather, **the data needs to address specific needs or important data gaps.** In fact, releasing too many datasets may have the opposite effect: a few good datasets can get lost ('buried') under a vast number of largely irrelevant or virtually useless other datasets. The necessity to liaise with potential or actual open data users is one of the key recommendations of the Africa Open Data Index 2018 and arose in most of the impact case studies.
A Deloitte 2013 report found that, of the estimated 37,500 public sector information datasets with over 2.5 million downloads, the "most popular, and potentially most valuable, datasets include geospatial, environmental, transport, health and economic data, with the construction, real estate, finance and insurance, public sector and arts, entertainment and recreation sectors being some of the largest users and re-users of public sector information and open data"[87] . The importance and desirability of geographic information is reiterated in another study where they found that *"The large majority (79%) of private re-users would like to access more public [government information], but unfavourable pricing and licensing conditions are a continuing barrier"* (Vickery, 2011, p.20).

Also, individual datasets do not create much value by themselves, as simplistic data value chain depictions sometimes seem to suggest.

There are many other factors that play a crucial role in determining the impact of open data. **The role of intermediaries is crucial: releasing the right open data into a mature and sustainable data ecosystem will ensure and enhance its impact when compared to immature ecosystems[88] .** Van

[87] The Deloitte (2013) study valued UK's public sector information in 2011 at between £1.2 and £2.2 billion, but its use and reuse impact at a multiple of that, with the social value alone estimated to be in excess of £5 billion. The study is still a useful read because of its very extensive, although now somewhat dated literature review, public sector information market analysis and many case studies.

[88] Refer to Gurstein (2011) for the importance of intermediaries: *"techies know how to do visualisation, university trained persons and professionals know how to use the analytical software but ordinary community people might not know how to do either and getting that expertise/support might be either difficult or expensive or both"*. The important role of intermediaries has been explored in much more detail and also more conceptually in (Smith & Reilly, 2013) The existence of diverse intermediaries has the potential effect of increasing the use and impact of open data since [..] *"no single intermediary is likely to possess all the types of capital required to unlock the full value of the transaction between the provider and the user"* (van Schalkwyk et al, 2016, p.20)

Although data camps or open data fests like to focus on single datasets in order to mine or visualize them for public consumption or data journalism, the impact of these exercises remains unproven. Deeper value propositions arise from combining or overlaying datasets (usually with at least a geographical layer), allowing for richer analysis (often focussing on a marginalized social group) and actionable insights. In a way, this can be compared to (any other) statistical analysis: descriptive statistics (which normally describes a single data attribute) is necessary and useful, but inferential statistics, using multivariate analysis, is usually much more powerful. In science, describing a phenomenon is the first stage, but analysing and explaining it (i.e. in terms of causal relationships between phenomena) is a higher stage of understanding. More often than not, data sources for a successful, impactful initiative will be heterogeneous, usually including private or crowdsourced data [89].

Schalkwyk et al (2017, p.8) suggest the following six crucial characteristics before open data can make a developmental impact: scrutiny, participation, equality, flexibility, trust and value amplifier.

Approaches and frameworks for measuring open data impact

Measuring the impact of OGD has proven to be notoriously difficult, given the vast nature of the social, economic, political, and environmental implications of the intended and actual use of OGD. The complexity involved in such measurement has been acknowledged, as well as demonstrated, by the rarity of established frameworks to measure the phenomenon (Verhulst and Young 2017), or studies that clearly assess the impact of OGD in great detail (World Wide Web Foundation 2016, Open Data for Development Network 2016). In light of this "counterproductive" scenario in the OGD research space (given the investments made towards OGD initiatives), the Open Data Barometer has emphasised the need for more structured research and analysis on the impact of OGD in order to demonstrate the value of the initiatives (World Wide Web Foundation 2016).

Given the difficulty in measuring transparency and government openness, the most prominent dimension of the impact that has been measured is an **economic impact**, with some studies attempting to quantify the financial contribution which open data actually or potentially makes towards economies (e.g. Manyika et al. 2013, Deloitte 2013, Tinholt 2013). As mentioned, the Open Data Barometer reported a 14 per cent increase in economic impact for the surveyed countries, while also pointing out the least impact on social issues (14 per cent decrease), as well as a decrease in political impact (World Wide Web Foundation 2016). The actual total social impact of open data is even greater, even though few studies have attempted to measure it. These studies only give approximate estimates (for specific countries) of the value resultant from the social impact of open data, given the lack of an appropriate framework to make more formalised estimates (Deloitte 2013).

The economic value unlocked by open data is typically ascribed to reduced friction in transactions and movements; as well as what economists describe as reducing information asymmetries, increasing allocative efficiency and enhancing network effects[90]. Intuitively, at least to aforementioned economists, the easiest way to measure this economic impact of open data is to attempt to quantify its direct and indirect monetary benefits. Indeed, a number of consultants have been commissioned to do this in the UK, EU and US. Perhaps not surprisingly, however, trying to quantify the impact in monetary terms produce tremendously varying estimates, ranging from 0.4% of GDP (Shakespeare 2013 study for UK public sector data only)[91] to 1.5% of GDP (EU Commission 2011 study for EU public sector data only)[92] to 4.1% (McKinsey's 2013 global study)[93]. The latter report claimed open data could unlock US$3.2 to US$5.4 trillion in economic value annually, with two-thirds of that value in the domains of education, transportation and consumer products alone. The McKinsey study, therefore, in the same year estimates an economic value globally ten times the percentage of GDP claimed by the Shakespeare study for the global economy, despite the UK's open data ecosystem being one of the most mature in the world. Although an order of magnitude's difference in monetary impact estimates naturally raises serious questions

[89] This was also a key recommendation and incentive for the OPAL initiative. See Canon (2017).
[90] https://medium.com/@ODIHQ/the-economic-impact-of-open-data-what-do-we-already-know-1a119c1958a0
[91] https://www.gov.uk/government/publications/shakespeare-review-of-public-sector-information
[92] http://ec.europa.eu/newsroom/document.cfm?doc_id=1093
[93] https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/open-data-unlocking-innovation-and-performance-with-liquid-information
[94] *"[E]stimating the economic value of open data can be a struggle. It can be difficult to isolate the net benefits, as open data is often used in conjunction with proprietary data"* (GODAN, 2018).

about the validity of this approach[94] , some essential facts remain: (1) it is important to attempt to assess the actual impacts of open data; (2) the economic benefit of opening the right government data is vast, outweighing the cost of the exercise even at the bottom range of the estimates; (3) some impacts can be quantified relatively accurately, but putting an actual monetary value on realized efficiencies or time savings is very dependent on the assumptions being made.

Most researchers will shy away from trying to put a monetary value on open data impacts, instead focussing on a more qualitative assessment. *"At least thirteen 'theories of change', including open data's ability to reduce transaction costs, generate new forms of economic growth and prosperity, generate new revenue models, and disrupt traditional business models"* have been proposed in the literature (Alonso, 2012). However, *"the consensus is that there is still much work to do on measuring the impact or the transformation potential of OD4D"* (Acevedo-Ruiz, 2017).

"Many aspects of well-being cannot be properly priced or monetarily valued such as the ability to read and write, longevity and good health, security, political freedoms, social acceptance and status, and the ability to move about and connect" (Beegle, 2016, p.11).

For instance, the GODAN Action Impact Evaluation Framework (Lokers, 2018) foregrounds the political economy as playing a dominant role in achieving open data impact. Thus, it analyses institutional constraints, stakeholder motives, power dynamics, sectoral structures and embedded values as important analysis considerations. Interestingly, it acknowledges historical legacies and the iterative, non-linear process that characterises the path to greater open data institutionalisation. The final impacts, i.e. benefits achieved by the (in GODAN's case, agricultural) stakeholders, develop from long-term outcomes which are, in turn, dependent on more specific and easier to achieve short and medium-term outcomes.

Verhulst's model, developed from a long-term involvement with major supra-national agencies promoting open data, can succinctly be stated as follows in his own words:

"Open data (supply), when analyzed and leveraged by both governmental and non-governmental actors (demand), can be used in a variety of ways (actions and outputs), within the parameters established by certain enabling conditions (and disabling factors), to improve government (accountability, service delivery and information sharing), empower citizens and users (better decision making, more choice, social mobilization), create economic opportunity (job creation, frugal innovation, economic growth) and/or solve societal problems" (Verhulst, 2017, p.19)[95].

Among the other prominent open data impact models, is that by the Sunlight Foundation which looked at the social impact of open data by mapping outcomes and behavioural changes (impacts) (Keseru & Chan, 2015). The GovLab/Web Foundation's Common Assessment Framework for open data looks at the environment/ context, dataset attributes, data use and impact. Davies et al (2016) presented a revised framework tailored to developing countries, and added inclusion/ empowerment, efficiency, innovation and economic development to the original impacts of transparency and accountability (refer also to the relevant quote in section 1: The imperative of Open Government Data for Africa). Importantly, it foregrounds the demand for data as a crucial ingredient in achieving sustainable impact.

There are other applicable impact evaluation frameworks that are not specific to open data. For instance, already in 2008, Richard Heeks detailed and illustrated 11 generic impact assessment frameworks in use for ICT4D (ICT-for-Development) projects. These include Cost-Benefit Analysis; Project Goals; Communications-for-Development; Capabilities Approach; Livelihoods Framework; Information Economics; Information Needs/Mapping; Cultural-Institutional and more issue/application specific ones (Heeks & Molla, 2008). Theirs is not a complete list, since more frameworks have been proposed since 2008, for example, Kleine's Choice capabilities framework (Kleine, 2010). Regrettably, it appears that very few of the open data-specific impact frameworks have drawn on the ICT4D literature.

[95] They also identified 27 enabling conditions and disabling factors as testable premises for determining the conditions under which open data works within developing economies. These factors and conditions were arranged into a "periodic table" under five categories, to be used to identify and assign indicators of the extent of impact. The metrics thus compiled can then be used quantify, or qualify, impact. This approach compares well with the Social Return on Investment (SROI) approach adapted by Stuermer & Dapp (2016) to develop their open data Impact Monitoring Framework. For each data category or dataset, it exhaustively identifies all the inputs, outputs, outcomes, and impacts. In tracing the pathways along which open data impacts on development, the identified enabling conditions and disabling factors are then arranged into the Impact Monitoring Framework in order to put the premises in perspective.

How open data contributes directly to achieving the SDGs.

It is common to perceive the primary role of open data in Africa as a sharing of data to disclose government information to citizens, allowing for greater transparency and, hopefully, engage citizens in democratic processes through participation[96]. Indeed, the value of strengthening peaceful democracies in Africa is hard to over-estimate and impossible to quantify: the success of any other development policy or intervention is almost entirely dependent on a stable, and an accountable socio-political environment. Furthermore, open datasets can be used to assess, interrogate and validate progress towards the SDG objectives as measured through the various indicators. This is the case especially for the majority of indicators where direct micro-data is unavailable or unreliable and innovative proxies have to be found.

However, OGD is not just a means to provide democratic transparency or allow other stakeholders to integrate and re-mix data to measure or assess progress towards achieving the SDG objectives. More powerfully, OGD can be harnessed directly to achieve sustainable development. The following table gives concrete examples for each of the SDGs of the potential positive impact of an Open Data initiative.[97]

Table 3: Example cases of OGD making an impact on specific SDGs.

SDG	Country	Illustrative impact case(s) of OGD[98]
No poverty	Ethiopia	CommonSense provides farmers with weather forecasts and other satellite-based information to help them make better planting decisions and improve their livelihood/reduce poverty. (Also provides access to insurance.)[99]
	Global	Humanitarian OpenStreetMap Team (HOT) provides maps for humanitarian relief and disaster response operations[100] .
Zero hunger	Uganda	U-Report used to treat and protect banana crops against bacterial wilt.
	Kenya	Prices and other agricultural info on the National Farmers Information Services (NAFIS).
	Ghana other	Esoko and Farmerline repackage weather, crop prices, advice and OGD to assist farmers
Good health and well-being	Sierra Leone	National Ebola Response Centre (NERC) used OpenStreetMap data to map incidences and response to the Ebola epidemic (Verhulst & Young, 2016).
	South Africa	Medicine Price Registry Application (MPRApp) provided official medicine prices to pharmacists and patients.
	Namibia	Tracking malaria factors and vectors using satellite and mobile phone data (Open Data Watch, n.d.).
	Nigeria	Budeshi monitors financial contracts and allows for advocacy for local primary health care centres (Seember, 2016).
Quality education	Kenya	Kibera's openschoolskenya.org map shows where Kenyan schools are located and the percentage of children not attending, highlighting under-served areas.
	South Africa	Open Education Data was being used by university planners already back in 2014[101]

[96] See for instance the analysis by van Schalkwyk et al (2017), p. 92 onwards, on Open Data in Nigeria themed around activism, advocacy and citizen participation.

[97] Many of the use cases can be linked to multiple goals, e.g. HOT maps their impacts to at least 8 different SDGs. Many more use cases can be found on the Open Data Impact Map http://opendataimpactmap.org/regions.html.

[98] We tried to include cases where actual impact has been demonstrated. However, this was not possible for all cases.

[99] GODAN (2017). CommonSense, Ethiopia - Food Security, Smallholder's Livelihoods. Available from https://www.godan.info/documents/ethiopian-smallholder-communities-provided-agricultural-information-based-open-source-satellite-data

[100] HOT maps their impacts directly to the SDG areas: disaster risk reduction, gender equality, environment, clean energy, transportation, sustainable cities, public health water & sanitation, poverty elimination, refugee response, disaster response areas https://www.hotosm.org/our-work. Although global, they are very active in West and Central Africa including Somalia, DRC, Zambia, but also Tanzania, Botswana.

[101] Although a bit dated, this empirically validated the occasional use but also interest in DHET and CHET-provided open higher education data (van Schalkwyk et al, 2014).

SDG	Country	Illustrative impact case(s) of OGD[98]
Gender equality	Uganda	Women of Uganda Network collects information about poor health care services to lobby health authorities
	Côte d'Ivoire	TechMousso ("TechWoman") focuses on health, education, safety and entrepreneurship data to identify gender disparities and advocate empowerment.
	Africa	ILO and WIEGO reconceptualised the measuring instruments for informal employment, exposing systematic under-reporting of women's work (ILO & WIEGO, 2013; Buvinic & Levine, 2015). The AfDB has created a Gender Equality Index.
Clean water and sanitation	Burkina Faso	Carteau maps water sources in the Sahel region of Burkina.
	South Africa	Cape Town's Day Zero campaign revealed household-level water consumption data on a map to reduce water consumption under drought conditions.
Affordable and clean energy	Kenya	The Electricity Supply Monitoring Initiative (ESMI), based on an Indian project, uses a cheap and straightforward IoT device to create Open Data that can be used to highlight areas systematically experiencing bad or no power.
	Senegal	A proof-of-concept demonstration in the Orange D4D Challenge showed the feasibility of using CDR data as a proxy for electricity consumption and thus for electrification planning (Orange, n.d., pp.10-11).
Decent work and economic growth	Côte d'Ivoire	The National Compendium of Women Competencies (COCOFCI) interactively profiles more than 10 000 women professionals, for advancing their political and economic opportunities.
Industry, innovation and infrastructure	Kenya/ Nigeria	Sagaci Research consulting company uses OGD.[102]
	Nigeria	Seedi (formerly MSME-ASI) uses open data and related transparency/advocacy tools to promote entrepreneurship and small business; with a focus on youth and women .[103]
Reduced inequalities	Kenya	A data journalist report lamenting the 'freeze' on welfare support to disabled and elderly which is traced back to systemic failures to track public money distributions (IODC, 2015).
	Uganda +	U-Report receives crowdsourced SMS reports on health, education, WASH by age, gender, location, reportedly 2 million reports in 19 countries in 2016 (UN, 2016)
Sustainable cities and communities	Burkina Faso	OpenStreetMap Burkina Faso maps Ouagadougou, "*to facilitate decision-making by local institutional actors and favour the [impacts] for citizens of community projects*"[104] ; used e.g., in the interactive Umap with SOTRACO bus routes.
	South Africa	Academic study demonstrates the feasibility of using satellite imaging to guide urban development (Musakwa & van Niekerk, 2015).
	South Africa	SCODA (SA Cities Open Data Almanac) provides data and visualisations of multiple urban indicators.[105]
	Kenya	MapKibera mapping urban slums and making their issues visible through advocacy (Chiliswa, 2014).
Responsible consumption and production	South Africa	The eLEAF/FruitLook uses satellite data to improve irrigation, claiming that 60% of 270 participants achieved 10+% water efficiency (GODAN, 2017).

[102] Open Data Fact Sheet (2016) "Business, Research and Consulting." Available from http://opendataimpactmap.org/

[103] http://www.msme-asi.org/index.php/2018-campaigns/ongoing-projects

[104] *"pour faciliter la prise de décision des acteurs institutionnels locaux et favoriser l'implication des citoyens dans les projets de la commune"*

[105] Including crime, energy, water, education, population, employment etc.

SDG	Country	Illustrative impact case(s) of OGD[98]
Climate action	Kenya, Ethiopia	International Livestock Research Institute (ILRI) created drought insurance and uses satellite imagery to prepare pastoral farmers against climate risks to become financially independent and self-sufficient[106]
	South Africa	The WWF combines several open data sources to estimate greenhouse gas emissions in Gauteng to propose interventions for lowering them (Lewis et al, 2016; WWF South Africa, 2016).
	Global	GlobalFishingWatch (GFW) uses satellite data and machine learning to monitor commercial fishing in order to promote sustainable fishing through transparency.[107]
Life below water	Kenya	Adopt-a-river Initiative crowdsourced data to monitor rivers' health on MiniSASS map platform[108] .
	South Africa	The Abalobi project helps small-scale fishers support the sustainability of the maritime resources and adapt to climate change. Fishers record oceanic, atmospheric and fisheries data and use dashboards to visualise it. Although they own the data, they can be shared with fisheries stakeholders. App source code is also Open Source
	Uganda/ Kenya	The Aquafish Innovation Lab collects and distributes data on fish prices and water quality, that can be used by FarmerLine & Esoko[109]
Life on land	Global/ Africa	GlobalForestWatch tracks forestry cover/loss based on satellite data since 2001 to date (2017) with dynamic map view or detailed country statistics. There is promising PoC work to use satellite imaging to track wildlife in under-resourced conservation areas.
Peace, justice and strong institutions	Burkina Faso	BODI's Open Election project in 2015 (discussed below)
	Nigeria	Follow-the-Money tracks and visualizes public money spent on projects.
	Kenya	GotToVote! Voter registration, awareness and crowdsourcing of election issues.
	Uganda	iParticipate analyses open data to encourage public participation.
	Burundi	Open RBF
	Africa	African Network of Centers for Investigative Reporting (ANCIR) was supported by World Wide Web Foundation and others to resources and have a coordinated analysis of Panama papers (50 media articles in 20 African countries).
Partnerships for the goals	Africa	AidData used by journalists to monitor foreign aid spending by governments and foreign investment (The Economist, 201). Furthermore, the sponsors of this report including the World Wide Web Foundation, UNDP, IDRC, and many other supra-national organisations such as the World Bank, the Africa Open Data Network (AODN); AODC; CAFDO; Global Open Data for Agriculture and Nutrition (GODAN), etc. are very active in this space by researching the area themselves as well as sponsoring a large number of organisations, projects and research reports.

[106] https://www.godan.info/news/ilri-using-satellite-imagery-protect-and-insure-livestock-east-africa 3 Feb, 2016

[107] Gutierrez et al (2018) explore 3 for profit and 2 non-profit initiatives of which Global Fishing Watch is the only one opening its data. The huge economic impact on African economies of illegal, under-reported and un-regulated fishing is highlighted by their reference to "IUU fishing costs just six West African countries close to 15% of their combined gross domestic product" (p.2)

[108] https://www.nema.go.ke/index.php?option=com_content&view=article&id=48&Itemid=195 It is unclear whether this initiative is still active.

[109] https://aquafishcrsp.oregonstate.edu/africa-project-kenya-uganda

ASSESSING THE IMPACT OF OPEN DATA IN AFRICA: SIX COUNTRY CASE STUDIES

8

"[F]or all the excitement and hype, there is still much that we don't know about the contributions of open data to social and economic development. The theoretical potential of open data has been established; but much work remains to be done, many challenges need to be overcome, and several gaps in our understanding must be breached if open data is, in fact, to help solve complex social problems and improve people's lives." (van Schalkwyk et al, 2017, p.2)

In the six country cases that follow, we have attempted to assess the impact made by Open (Government) Data holistically. While mindful of the above frameworks, we have not felt limited by the dimensions suggested in any one model.[110] However, a future, more systematic future research project focussing on open data impact intending to provide both longitudinal and cross-sectional comparability will benefit hugely from adopting a standardised theoretical framework.

[110] An explicit mapping of the Open Data impacts to some of the frameworks mentioned was done by some country researchers. This can be found in the detailed country reports which will be available separately for download.

Country case: Kenya open data impact

Country context

Open data in Kenya was accelerated by its intent and commitment towards the Open Government Partnership (OGP) in 2011 (Open Government Partnership, 2011). This agreement was accompanied by the launch of Kenya Open Data Initiative (KODI) portal and a few use cases in the form of mobile applications that helped in demonstrating the potential value of open data to the public. This was made possible through the political, financial, and technical support of various stakeholders including The World Bank, private sector organisations such as the Nation Media Group and Standard Media Group, a civil society such as Twaweza ni sisi and Mzalendo, academic institutions such as Strathmore University, and NGOs such as Hivos.

Kenya has since enacted a few enabling laws, which have assisted in resolving some of the bureaucracy. The Access to Information Act of 2016 (Kenya Access to Information Act, 2016) grants citizens the right to access public information or data held by a public entity. Article 31 of the 2010 Constitution of Kenya guarantees the right to privacy, which protects citizens from having information about their family or private affairs from being unnecessarily revealed. The Kenya Open Data Policy remains in draft stage and is necessary for stimulating and guiding the publication of government and non-government data that is of public interest, and deriving advantages from its use (Kenya Open Data Policy DRAFT, 2014).

Kenya's OGD is mainly supplied by the Kenya ICT Authority through the KODI Portal and the Kenya National Bureau of Statistics (KNBS) through their data visualisation platform and the Kenya National Data Archive (KeNADA) portal, which contains a collection of KNBS survey datasets. The KODI portal contains an engagement mechanism, which allows ordinary citizens to make requests for inaccessible government datasets. Despite these efforts, only 31 out of 83 government agencies are releasing some of their datasets. The Kenya Open Data policy is necessary for guaranteeing the supply of government data, and providing clear guidelines on the role of the various government agencies in supplying OGD (Mungai, 2018).

Despite the lack of some of the fundamental legal and policy structures, there have been more than twenty data-driven initiatives since the first launch of KODI in 2011. Some of these have managed to achieve their intended outcomes, while others have played an important role in creating awareness and sensitisation on the use of open data. An assessment of the impact of these open data initiatives is provided below.

The Kenya open data ecosystem 'supply-side' is not limited to government, but also includes the private sector and civil society; this will be detailed in the following section.

The impact of open data

This section provides an account of the various innovations that constitute the Kenya open data ecosystem. A more comprehensive account is available in the detailed country case.

The Kenya Open Data Initiative (KODI)

The **Kenya Open Data Initiative (KODI)** is a government portal that provides government developmental, demographic, statistical, and expenditure data available as open data, mostly in accordance with the open data principles. KODI is managed by the ICT Authority, a government agency under the Ministry of Information, Communications and Technology (ICT) (Kenya ICT Authority, 2018).

A Development Initiatives study in 2014 on the impact of KODI on marginalised communities resulted in four key findings: a mismatch between the needs of the citizens and the data currently provided on the portal; most people seek information from local intermediaries instead of KODI; rural communities are less likely to access KODI; and the data needs in Kenya for service delivery are likely to differ from the needs in other parts of the world (Mutuku & Mahihu, 2014). However, that study was conducted in 2014, when KODI only had 262 datasets, sourced from just four government agencies; KODI now has more than 680 datasets, sourced from 31 different agencies. KODI has since introduced the 'request-a-dataset' feature on the portal to assist in determining the needs of the citizens and interested organisations.

In addressing the observation that people are less likely to seek information at KODI the ICT Authority has also conducted several awareness campaigns through open data workshops, bootcamps, and conferences. They also launched the significant number blog, which provides examples of the kinds of insights that people can derive from the existing datasets (Mungai & Van Belle, 2018).

Newsplex

Newsplex is a data-driven column in the Daily Nation Newspaper, supported by a dedicated data journalism news desk within the Nation Media Group (NMG). The news desk was formed in July 2015 motivated by an increase in the availability of OGD, and global discussions about data-driven journalism. To date, NMG is the only media house in Kenya that has a dedicated team focused on data-driven journalism. Newsplex columns are enriched with infographics, which assist in presenting complex data and information quickly and clearly. The Daily Nation online portal receives high traffic, which Newsplex has capitalised on, leading to more data-driven citizen engagement. Newsplex also publishes open data arising from their research activities. For instance, they published the Deadly Forces database, which consists of data they generated while investigating the number of people killed by police in Kenya. This resulted in the publication of nine Newsplex columns in 2016, and a few documentaries on NMG's Nation Television (NTV) which sparked national debates on police brutality.

Mzalendo

Mzalendo seeks to promote citizen engagement in politics by providing relevant information about activities and decisions carried out by the National Assembly and the Senate. They also generate unique research output from the data including a ranking of Parliament and Senate officials based on performance and advocacy, blog posts, infographics on parliamentarians' performance report card, detailed info cards on Parliament and Senate representatives, political party coalitions, parliamentary speeches, and copies of legislation. Mzalendo also provides open access to its website data in a machine-readable format including JSON and SQL formats.

In terms of impact, a small number of members of the National Assembly have either responded to comments made on their profile, while another group reached out to their constituents offline based on the online debates, as was the case during the 2007 election (Sasaki, 2010). Mzalendo's work has also been cited by most of the leading media outlets including BBC, CNN, Daily Nation, Standard Digital, Citizen Kenya, and People Daily.

In an interview, Mzalendo agreed that KODI has contributed to open governance, but in terms of data, they have not been able to provide the datasets requested by Mzalendo, which has led them to find alternative ways of accessing data. Mzalendo leverages its network mainly for data, sourcing mostly personally from people in target offices, including those in government and independent institutions like the Independent Elections and Boundaries Commission (IEBC). Many people reach out to Mzalendo for information about elections. Some of this information includes information on parties, polling stations, IEBC registration centres, and voter education. This happens in cases where such information is not directly accessible, or hard to find. In 2017, IEBC commended Mzalendo for amplifying their work to the public.

Mzalendo acknowledges that the current constitution and more specifically the Access to Information Act of 2016 is fairly sufficient in ensuring data access. By having access to the right networks, Mzalendo is able to leverage this constitutional provision to ask for data. A limitation faced by Mzalendo includes lack of support for local initiatives by donors in the open government and accountability space. They seem to be more inclined to support westerners, bypassing local initiatives that already have observable traction. In addition, the attitude of the political class in Kenya has made fundraising very difficult.

ILRI GIS Portal

The International Livestock Research Institute (ILRI) has been using open satellite data to monitor drought in Northern Kenya's arid Marsabit District. This data helps in determining the availability of fodder crops in the arid region, with the aim of assisting pastoralists in preparing for climate risks (GODAN, 2016). ILRI provides open access to their Geographic Information System (GIS) portal. This initiative can also be extended to assist crop farmers by providing satellite-based crop advice (CTA, 2018), and determining groundwater potential in arid and semi-arid areas (Kuria, 2012). For instance, Landsat imageries from ILRI and the United States Geological Survey (USGS) were used in determining the groundwater potential in Kitui district, a semi-arid region in the Eastern province of Kenya, with a population of 1,012,709 according to the 2009 census (Kuria, 2012).

The impact of open data on agriculture in developing countries is still low. Smallholder farmers in rural parts of Kenya can benefit from agricultural open data, providing early warnings of adverse conditions, which would result in greater productivity and better nutrition (Jellema, Meijninger, & Addison, 2015).

Electricity Supply Monitoring Initiative (ESMI)

The Electricity Supply Monitoring Initiative (ESMI) is a joint venture between the World Resources Institute, Prayas Energy Group (PEG), and EED Advisory with

support from the World Bank and other partners. The ESMI approach conceptualized, developed and implemented in India by PEG uses a crowdsourcing methodology to generate accurate, granular and near real-time data about the quality of electricity supply. Mobile data enabled electricity supply monitors record voltage data which is published daily on esmi-kenya.org. ESMI-Kenya project aims at providing evidence-based feedback on the quality of electricity supply across different areas and income level classes across Nairobi County (ESMI, 2017). The electricity supply monitors are assisting in monitoring consumer usage in-terms of minute by minute voltage a household user receives including voltage fluctuations and blackout. Although the data is made available to the public, there is no particular impact from the use of this data as yet, though EEDA has been receiving requests for this data, especially from people in industry. Hopefully, their data can help in validating or improving data collected through surveys. It also helps in unveiling inequalities and provides evidence for the public, regulators and civil society groups in pushing for service improvements. For instance, data collected from Kibera and Kawangware, both of which are low-income areas, revealed vast differences in the number of supply hours and voltage fluctuations of different households in the same community. This information could be used in pushing for better services in these communities (Odarno et al., 2018).

Map Kibera

Map Kibera is an open data initiative that focuses on mapping informal and rural settlements in Kenya. It leverages OpenStreetMap in creating maps for these settlements, allowing them to share their maps on their Open School Kenya Website. Their most successful project is found in Kibera, which is the largest informal settlement in Africa. Later other settlements within Nairobi were included, such as the Mathare, Mukuru kwa Njenga, and Kangemi slums. The Kibera mapping used five thematic areas namely education, health, security, water and sanitation. The strategy in Kibera and other sites is to incorporate mapping effort with citizen journalism. In Kibera, this is achieved through Kibera News Network, a video network which allows people to talk about the issues affecting them and talk about the issues that have been highlighted by the map. This network gives people voice, as they can speak about this on camera during the interview and use the map as evidence to support their claims. In addition, there is also the Voice of Kibera network, where people can send SMSs of what's happening around them.

Map Kibera has had a significant impact, especially in Kibera. The mapping exercise was a big surprise to the government, especially with regard to the number of schools in the area. Map Kibera data revealed approximately 350 schools, while only 100 schools were in the government records. They had managed to go into areas where perhaps the government could not access. At the onset, informal schools were afraid of not having the required operational licences. They feared that documenting them would expose them and the government would close them down. However, to everyone's surprise, after the government viewed the data, they decided to accommodate them by establishing a new program called APBET schools (Alternative Provision of Basic Education). APBET created a channel that enabled these schools to be registered with the government.

Map Kibera is also working with Kenyan counties to help them map their projects linked to county expenditure, through a process called participatory budgeting. This initiative started with Makueni County and is now in Baringo County as a pilot project aimed at scaling to all the 47 counties. Map Kibera has also been successful in other sectors. The Nairobi City Council officials requested a water and sanitation map, a health map, and security map with the aim of improving water, health, and security facilities in Kibera. Since then, there has been an increased provision of health facilities including mobile clinics. The issue of "flying toilets" also reduced after toilets were dug in the area. In addition, places that were marked as insecure in Map Kibera are more secure through additional lighting at night and permanent police posts, thereby reducing the incidents of mugging.

GoToVote!

GoToVote! was built as a Code for Kenya data journalism project in an effort of improving access to Kenya's voters register, which was cumbersome to use as it was only released by the Kenya Independent Electoral and Boundaries Commission (IEBC) as one large PDF file. Code for Kenya scraped the data out of this document and built a simple website that gave citizens quick access to their registration centres, through an easy-to-use search feature. The latest version of the application now allows citizens to spread messages of peace through free SMS messaging to friends and family during the period of elections. It also contextualises the results, by overlaying ballot returns with information about local trends, and official reports of election malpractices (Code for Kenya, 2018).

Uchaguzi by Ushahidi

Following the 2007 post-election violence, Ushahidi was inspired to create a platform that enables a more

transparent, peaceful, and fair election environment (Wrong, 2013). Using Ushahidi's crowdsourcing platform, Uchaguzi was developed. Uchaguzi is a web-based crowd-sourced map of Kenya that visualises citizen engagement on suspicious or violent activities in their area. This engagement also includes civil society activists, election monitors, and local officials. Users send messages to the platform using either SMS, twitter, direct phone calls or email. Ushahidi shares this information with the necessary authorities and makes a follow-up on the action. These users are protected by making such messages anonymous (Wrong, 2013).
The initiative began during the general elections in 2013. The platform engaged with more than 8,000 respondents with nearly three-quarters of them later reporting that the incident they had reported was resolved (Wrong, 2013). In 2017, more than 1,200 independent observers were deployed across the country, with each constituency being allocated four observers. Their observations were sent to the platform, giving a more representative view of the elections with regard to violence and any other suspicious activities.

This platform allowed Ushahidi, Infonet and CRECO to monitor the 2017 elections using real-time data, which was then processed (translated, geo-located, structured), verified and published for either research and analysis or escalated to the necessary authority for action. This platform helped in identifying 29 cases that needed an escalation in relation to security and violence, 55 reports in relation to voting tallying, 84 polling station and election administration issues, and a total of 104 security reports. This information was processed from a total of 12,900 messages (Mugo, 2017). The data and information that resulted from it was a significant contribution to the election process and contributes to election transparency and accountability efforts.

Active innovations with potential impact
An additional number of open data-related innovations were uncovered where the immediate impact has not or could not be assessed. These are described in full in the separate country detail report. What follows is an abbreviated listing.

MedAfrica is a free, mobile phone application that allows consumers to access medical information and locate nearby doctors and hospitals of high repute (CHMI, 2012). Despite initial interest, the application has not gained traction yet because of its B2B focus, but the developers have revised their business model and are busy upgrading their offering.

CountyTrak Index (CTI) seeks to ascertain citizen assessment on the performance of their government against set performance indicators and develop a citizen scorecard on the performance of their county governments. The first research was conducted early 2015. In 2017, they conducted a Nation Media Group-syndicated popularity poll on the aspirants of Nairobi electoral positions. CTI has helped in providing quantifiable evidence on county performance and provided citizens and government with insights on how to improve performance at the county level. For instance, the number of overseas trips by county governments on the grounds of benchmarking has greatly reduced.

The EduWeb platform is an online and mobile app-based education listing platform providing location and contact information for primary and secondary schools. Sadly, it lacks access to the most current datasets from the Ministry of Education.

StarHealth is an online and USSD-based search functionality developed by Code for Kenya for The Star that assists ordinary citizens to verify the legitimacy of a medical doctor, assists users to determine the nearest doctor or health facility, and or which health facilities are covered by the National Health and Insurance Fund (NHIF) (Looney, 2014; The Star Kenya, 2017). However, the solution is yet to gain traction, and that there is a need for more awareness, which would lead to increased use.

PesaCheck is an online platform developed by Code for Africa and used in East Africa (Kenya, Tanzania and Uganda) to assist citizens in verifying government development facts, especially with regard to claims made by public figures regarding budget versus actual expenditure. This assists in promoting accountability, by allowing people and organisations to consistently monitor what the media, government representatives, and politicians report (Lakin, 2016).

Virtual Kenya is a web-based interactive and learning resource that provides Kenyans with high-quality spatial data and cutting-edge interactive mapping technologies to further their educational and professional pursuits in human and environmental health (MacMillan, 2011; Omenya, 2012). The platform allows users to view, download, share, and comment on various map-based products sourced from World Resources Institute (USA), International Livestock Research

Institute (ILRI), the Kenya Department of Resource Surveys & Remote Sensing (DRSRS), and Kenya National Bureau of Statistics (KNBS) (MacMillan, 2011).

Inactive innovations with past observable impact

Many past open data-based initiatives and innovations have been discontinued, despite making an impact. These included the Health Emergency Management App (HEMA) with information about nearby health facilities; the Kenya Budget Explorer visualizing budget allocations and expenditures; Find My School assisting prospective parents with their school choice; County Safety Visualisation visualizing crime trends across Kenya; Msema Kweli, a mobile app showing how local government Constituency Development Funds (CDF) were being spent; and DataStory on Elections/Siasa API providing easy-to-use features to create rapid visualisations of open data (Wambui et al., 2013).

Critical assessment and discussion

An assessment of the innovations made by the various stakeholders reveals that the civil society and private sector have made significant strides towards the supply and use of open (government) data. These innovations are mainly designed to promote transparency and accountability and to improve the provision of social services including equitable distribution of resources, government service delivery, and democratic processes including elections and parliamentary proceedings.

Table 4: Kenyan open data innovations by sector

Government	Civil Society	NGO	Private Media	Private Company
Kenya Open Data Portal (KODI) KNBS portal KeNADA	Mzalendo Map Kibera GotToVote OpenDuka HuruMap PesaCheck openAFRICA africanSPENDING Kenya Budget Explorer Find My School	ILRI GIS Portal	Newsplex StarHealth County Safety Visualisation DataStory on Elections and Siasa API Deadly forces database	DataScience LTD ESMI Ma3Route MedAfrica App CountyTrak Index EduWeb (online) Virtual Kenya Hema Mobile App Msema Kweli (County Scorecard) Hosii/Primo/Sekoo App

The assessment also demonstrates a rise in data-driven journalism, especially by Nation Media Group, which not only produce weekly columns but has also contributed to the supply of open data. This leads to another observation on the role of financial and political backing in the success of these initiatives. For instance, EduWeb received no support, and its solution is yet to realise their intended outcome. Ma3Route is an exception to this as it grew organically without initial funding. All the other innovations that are still active with noticeable impact were initiated by organisations with existing financial and social networks. This observation links well with Reilly and Alperin's (2016) argument that the ways open data is connected to meaningful use are dependent on the actors and stewardship regime that is involved in the intermediation process. As a result, there is a need to determine whether powerful actors engage in intermediation strategies that align with the types of social value that citizens prioritise. This involves uncovering and confronting actors' power and position, values and relationships and how and why the needs and wants of others (who might benefit from open data) go unmet (Reilly & Alperin, 2016).

Recommendations for OD in Kenya

There is a need to strike a balance between the needs of the intermediaries, and those of the citizen. In achieving this, the following suggestions are recommended for the Kenyan case.

- Currently, only 31 out of 83 government agencies are supplying some government data. A higher government commitment in the supply of OGD needs to be secured. This could be achieved through the completion and implementation of the Kenya Open Data policy.
- There is a need for more participation from the private sector and academic institutions, since they provide unique insights, datasets, and have the potential to provide useful innovations that will result in positive social change.
- More assistance needs to be provided to new and existing open data innovations in an effort to broaden the diversity in the current stewardship regime and address some of the unmet needs of citizens.

Country Case South Africa: tracing the impact of the City of Cape Town's open data initiative

Country and city context

South Africa (SA) currently does not have an open data policy in place. However, the government has made high profile commitments, including joining the Open Government Partnership (OGP). In September 2016, the National Integrated ICT Policy White Paper was published, with one of its objectives being to *"provide the framework for implementing Government's commitment to open governance and open data"* (Department of Telecommunications and Postal Services 2016, p. 117). However, given the commitments made regarding OGD, SA has not particularly made consistently progressive strides in implementing open data principles. Earlier enthusiasm was demonstrated by the launch of the Department of Public Service and Administration (DPSA) beta version of SA's open data portal in October 2015 (Van Schalkwyk 2017) with 409 datasets which, as of 29 June 2018, have not been updated. Besides the beta open data portal, there is no other indication (at least at the national level) of effort to actually implement the OGD commitments made. However, some SA government departments and agencies do publish substantial amounts of their data online (e.g. the Department of Higher Education and Training, the National Treasury and Statistics South Africa) although the datasets have no open licenses attached.

Cape Town is the first city in Africa to establish an open data presence, a remarkable achievement given the relatively slow development of the national open data initiative. Inception for developing the open data initiative was the initiation of an Open Data Forum by the Western Cape's Member of the Executive Council for Finance, Economic Development and Tourism, which prompted the City Mayor's Office to conceptualise the idea of the initiative (Willmers et al. 2015). The forum brought together stakeholders interested in open data, which resulted in the idea of establishing an open data policy. The City Mayor's Office tasked the city's Development Information and Geographic Information Systems (DI & GIS) Department with initiating discussions about developing a document on open data policies and practices, and how the city could implement these (Willmers et al., 2015). The resulting document served as a basis for the eventual Open Data Draft Policy published in February 2014 (City of Cape Town, 2014). The city's open data portal was then launched in January 2015 as part of its Digital City Strategy (Stelzner, 2015). As of 02 July 2018, the portal currently has 119 datasets covering several areas including agricultural land, fiscal data, air quality, industrial statistics, and locations of amenities amongst others. The datasets clearly cover important areas that would be significant in driving a socio-economic impact. A significant driver of the development of the open data initiative by the City of Cape Town is the intention to create an environment attractive to investors, which is expected to generate economic growth, create jobs and improve the city's residents' lives (Willmers et al., 2015). The launch of the portal is also meant to give users easy access to up-to-date data that is otherwise not easy to extract from government agencies' websites.

Noteworthy is the similar open data initiative emerging in Durban; Open Data Durban is a civic technology lab that implements and advocates for open data, open government, and civic technology through various activities (projects, hackathons, workshops, etc.). Although they do not, as yet, actually supply data, they work with civil society, the media, government and any interested stakeholders advocating for the use of information to empower citizens. Although the Durban local government is not directly involved with the initiative, they have taken a keen interest in the initiative which is, hopefully, an indication that the city would also like to develop and launch an OGD initiative (Eyal, 2015).

Tracing the development of Cape Town's open data initiative

The launch of the City of Cape Town's open data portal has preceded and inspired some notable developments over the past three years. Most notably, the existence of the open data portal has enabled and facilitated the organisation and execution of hackathons aimed at finding innovative solutions to some complex problems the city has been facing over the past three years. The overarching goals of the hackathons can be placed within the four pathways along which open data impacts on development.

The following table gives a brief summary of the events and developments whose inception may be directly (or indirectly) linked to the City of Cape Town's open data initiative.

Table 5: Events and Developments Inspired by the City of Cape Town's open data Initiative

Event/Initiative Name and Dates	Brief Description	Main Objectives	Impact on Development Pathway
Smart Communities Hackathon – 19 to 20 August 2016	Collaboration between the SA Innovation Summit, the City of Cape Town (CCT), The Barn-Khayelitsha, and the Cape Craft + Design Institute. The initiative was driven by the CCT, within its Digital City Strategy and long-term commitment to improving communities. Part of the data used in the hackathon was from the CCT's open data portal.	Identify and find innovative solutions to the wider Khayelitsha community's most important needs. Find innovative solutions for fighting crime and improving service delivery. Find innovative ways to improve the quality of life of the elderly in the community. Find innovative ways to sustain incremental improvement of informal settlements.	Helping to solve complex public problems.
Open Data Tourism Hackathon – 27 to 29 October 2017 (Bizcommunity 2017)	Collaboration between the CCT and the Cape Innovation and Technology Initiative (CiTi). The hackathon sought to find a digital tool to enhance the experience of tourists visiting the CCT by facilitating the process of finding unique experiences around the city. The data used was from the city's open data portal, complemented by some other data provided during the event.	Design a digital product that improves the discoverability of unique experiences for tourists in Cape Town. Solve real problems being faced by the city's tourism sector.	Creating economic opportunity
Business and Government Data Exchange Workshop – 7 March 2017. (Accelerate Cape Town 2017)	Workshop organised by Accelerate Cape Town and hosted by Deloitte. The workshop was organised under the company's Digital and Tech Programme and sought to answer questions about what additional insights may be gained about customers, market and economic conditions, by having access to government data.	Determine what government datasets are currently available and what data government could make available for business to enhance business processes and contribute to the ease of doing business. Determine how data is currently shared and what technology is available for effective sharing. Understanding South Africa's legislation relating to data privacy, POPI and the exchange of data. Foster collaboration between business and government and determine the next steps following the workshop to enhance this collaboration.	Improving governance

Event/Initiative Name and Dates	Brief Description	Main Objectives	Impact on Development Pathway
Cape Town Water Crisis Hackathon – 24 and 25 February 2018. (Kamaldien 2018)	Initiated by Stop Reset Go and the Cape Town Science Centre with support from a global solidarity network including Open Source Circular Economy Days initiative, Envienta Open. The hackathon sought to explore, ideate, hack and develop solutions to the city's water crisis. Solutions and ideas developed would also be shared with other cities around the world faced with the same problem.	Develop innovative solutions and ideas to alleviate the effects of the city's water crisis	Helping to solve complex public problems
TrainUp Data Training Workshops using open data (OpenUp 2018)	Run by OpenUp. Described as a "Data-driven storytelling training for people working in public and private sectors who need to communicate information in an effective and easy-to-understand way".	Train the public on: Sourcing and cleaning data Analysing data for storytelling Packaging and presenting findings	Helping to solve complex public problems
Economic Development Partnership (2014)	One of its programmes titled 'Partnering Knowledge-Sharing' involves engaging in a broad range of partnering learning and knowledge-sharing activities which take the form of writing, publishing, teaching, building communities of practice and knowledge networks, and building the EDP as a learning organisation.	Managing interactive knowledge sharing events and workshops including the Open Data Forum Publishing partnering learnings and best practice locally and internationally Providing internal training on partnering practices and skills Publishing partnering learnings and best practice locally and internationally	Creating economic opportunity and helping to solve complex public problems

Tracing the impact of the initiative

The City of Cape Town's open data initiative has undoubtedly gotten communities and organisations involved in the conversation and developments around OGD. Tracing the impact involves following up on the extent of achievement of the objectives set by the events and activities in Table 5. There have already been current developments that can be attributed to the expected effects of OGD. One such relevant development is the case of the problems that have been faced by the Mayor of the City of Cape Town. Mayor Patricia De Lille has recently been criticised owing to speculations and reports from the office of the Auditor General about inconsistencies in the tendering process for a transport tender, and renovations to the Mayor's private home using city funds (Diphoko, 2018). As importantly pointed out by Diphoko (2018), such matters would be clear if the city's OGD were genuinely open and such information would be available for the public to see. Clearly, questions are being asked that have been motivated by the OGD concept, and this constitutes part of the intended impact of open data.

Impact findings

Using the framework suggested by Verhulst and Young (2017), the impact of the City of Cape Town's open data Initiative is traced along the lines of the objectives set forth by the events and developments surrounding OGD in the city. The objectives in Table 5 certainly border around creating economic opportunities (Business and Government Data Exchange Workshop), creating solutions to complex public problems (water crisis hackathon), improving

governance, and empowering citizens. These themes are explored in depth to paint a clearer picture of the extent of impact from open data in Cape Town.

The preliminary themes indicated by the initial data collected (interviews) include data-literacy training facilitation and data intermediation. Inception points of impact include the usage of open data by data-science training initiatives and the open data usage advocacy championed by open data intermediaries. The impact is only possible when there is the significant use of open data, and these two areas practically facilitate the usage of open data. The extent of usage and subsequent impact may not be definitively determined, but from the interviews, there seem to be promising indications of impact from the initiatives.

One important developing country context feature into which open data is contributing is the nurturing of one critical and scarce skill, data literacy. Lack of data literacy has been acknowledged as an inhibitor of increased usage of open data, or data in general (Janssen *et al*., 2012). Explore Data Science, an academy in Cape Town that offers a one-year data science training course is one initiative that is actively addressing this challenge. The academy trains students to use real-world data, some of which is obtained from the City of Cape Town's open data portal, to explore relevant social problems and develop innovative solutions. This coincides with another developing country context feature, which is the use of open data as a tool to facilitate scrutiny of relevant public services. In using the data from the city's data portal, students at Explore Data Science explore the data in-depth, critically scrutinising the quality and context of the data. A relevant example is the students in the current (2018) stream noticing the inconsistencies in the City of Cape Town's weather data when compared to other purchased data, and expressing concerns about the water consumption data. Impact in this regard may not be substantial given that it is confined to the students, but it does contribute to creating a culture of critical data usage.

OpenUp[111] is also playing an active role in contributing towards the developing country features discussed in the previous paragraph. They provide two-day data storytelling short courses that are open to the public, in which they train people on the use of data (and open data) to communicate information in an effective way. They also facilitate data usage by obtaining data from various sources (by means of downloading already available data, web scraping, pdf scraping, prior requests, etc.) including government ministries, departments, and agencies, and then clean and make it available to the public in more useful and understandable formats on their portal. This contributes to another developing country context feature, value amplifying. Presenting data from various sources in more understandable and useful formats increases the likelihood of increased usage, and thus impact, hence amplifying the value of the data. The actual extent of impact may be difficult to discern, but there have been indications of appreciation, ergo impact, of the efforts made by OpenUp. The Medical Price Registry tool which checks medicine prices before filling a prescription, checks for possible generics, and basically ensures that patients are not being overcharged for medicine, was even appreciated by pharmacists and doctors. Businesses have also expressed appreciation for the Trace tool which makes corporate data freely available, enabling businesses to keep track of their competition and empowering the public to hold the corporate sector accountable for their actions, should it be necessary. Within the developing country context discussion, we can identify the pathways along which open data specifically impacts on development. One such pathway is open data as a tool in helping to solve complex social problems. Students at Explore Data Science are given real-world data and tasked with finding plausible real-world solutions from the problems indicated by the data. A relevant example is their use of the City of Cape Town's dam levels and water consumption data to attempt to find solutions to the Cape Town water crisis resultant of the drought that has affected the city since 2015 (Dewald, 2018).

This is a practical use of open data, which addresses a critical social problem. Again, although the impact may be minimal, given the confined usage, it still inspires interest in the students, which could eventually lead to impact. At this stage, the impact

[111] OpenUp, formerly known as Code 4 SA, is a civil society group advocating for data liberation, data literacy, citizen empowerment, active citizenry, co-governance, and civic technology. They run several initiatives to support a culture of data innovation, active use, and information use to empower people in South Africa. They run data training courses, and conscientise society on the importance of active citizenry through the use of available data. Furthermore, OpenUp has partnered with some multilateral organisations to create APIs that facilitate data retrieval from various sources (including governmental). The data retrieved by their APIs is consolidated into an open data portal, which currently has 125 datasets. Data from the portal is downloadable in machine readable formats and the APIs allow users to see visualisations of the data. However, there is no explicit open licence attached to the datasets.

cannot be discerned, given that the academy only started running this year. The academy also makes recommendations to the City of Cape Town based on their findings, although they would not know if the City heeds their recommendations.

Specific impact factors can then be identified within the pathways along which open data impacts on development. Within the overarching impact theme of 'Culture and Expertise' (as suggested by Verhulst and Young, 2017), open data contributes towards the development of skills and expertise and technological literacy. This is demonstrated by the use of open data in the Explore Data Science Academy, and in the use of open data by OpenUp to train the public on data literacy. Furthermore, the academy has developed a dashboard for the City of Cape Town, which gives a live interactive interface for pointing out where the issues with data are. This facilitates a feedback loop, another specific impact factor within the 'Culture and Expertise' overall impact theme.

Critical impact assessment

The Open Data and Impact Monitoring Framework suggested by Stuermer and Dapp (2016), which is based on the SROI approach, will be used to base a critical assessment of the impact of open data, as observed in the context of the City of Cape Town's open data initiative. Table 6 gives the impact monitoring framework, with details obtained from information collected from stakeholders in the open data 'ecosystem' in Cape Town, and South Africa in general.

Table 6: The Open Data Impact Monitoring Framework with content from South Africa

Data Category	**Input** *Native data, money, people, infrastructure, equipment etc*	**Output** *open data portal with metadata, updated content, open format etc.*	**Outcome** *Hackathons, apps, new firms, linking of data, research, etc.*	**Impact** *Intended and/or realised net effect of output intervention*
Water	Dam levels for the City of Cape Town's supply dams The city's water consumption data	Regularly updated data portal with granular dam level information, and water consumption data	Hackathons making use of water data to propose solutions for the city's water crisis Data literacy training programs making use of the water data	Increased usage of data to help solve complex social problems Better informed city residents on critical issues that affect them
Medical	Official prescription medicine prices as regulated by the Department of Health Pricing information on generic alternatives to prescription medicine	OpenUp's open data portal with regularly updated data	Medicine Price Registry – Web application on which patients can check for official prescription medicine prices, and generic alternatives	Patients not having to overpay for prescription medicine Better informed patients on generic alternatives which could save them money
Company	Corporate information Tender award information Information on restricted suppliers Company information on open gazettes and the stock exchange news service	OpenUp's open data portal with regularly updated data	Trace – Web application which consolidates corporate information from various sources	Empower the public to hold corporations accountable Enable companies to keep track of their competitors and facilitate fair business practices

Although there are some indications of impact from open data usage, the impact seems confined to a few groups of people with specific interest in specific open data. The data science academy makes specialised use of the data, with the students being the beneficiaries of the open data usage. The confined impact essentially includes inciting the inquisitive and innovative use of data on critical and relevant social issues. The academy also created a live and interactive dashboard for the City of Cape Town to see where the issues are with the data on their portal. However, there has not been any discernible indication that any changes are made to take advantage of this feedback loop. Thus, the impact of the projects and services that have open data as an input is at a specialised interest confined level, and far from a national level, or even a subnational level.

The impact from the use of the open data inspired web applications by OpenUp is evidently present, indicated by open data stakeholders expressing appreciation for the influence from the usage of information from their web applications. Doctors express appreciation for cost savings made by their patients, while business personnel appreciate the ability to be able to keep track of their competitors. These are positive indications of impact, although the extent of the impact cannot be definitively stated.

A relevant indicator of impact, or at least a substantive likelihood of eventual impact, is awareness of the existence of open data. Awareness may be seen to indicate the usage of open data, or at least the intention to use it. It would seem though, that awareness of the presence of open data is very low. The academy only became aware of the existence of the data after actively looking for it. A review of the relevant literature (media articles) reveals that most references to open data are for the periods and activities preceding the launch of the City of Cape Town's portal, and the hackathons. There appear to be no follow-up articles on the progression of the open data initiatives. It is as if the media articles only serve the purpose of 'hyping up' open data milestone events such as portal launches and high-profile hackathons. Follow-up articles would at least maintain the consistency of awareness around open data usage and resultant impact.

Research and policy recommendations

There is evidence of impact from the reviewed open data initiatives. However, it seems confined to specialised groups, and the extent of impact from projects/services resultant from the use of open data is limited. A notable indicator of this lack of widespread impact is the minimal awareness of the existence of open data. In this regard, open data suppliers need to make better efforts to publicise the existence of open data. The media articles reviewed seem to focus on the activities preceding milestone open data events such as launches and hackathons. Thus, consistent media coverage of the milestone events and activities relating to open data is encouraged. The data suppliers could champion such a drive. They could conceivably achieve this by imploring the media to consistently cover any significant activities resultant from the use of open data, for instance, if applications are developed, how the usage of those applications progresses.

Another notable observation relating to the media coverage of open data events is the absence of links to the open data portals anywhere on online articles. Such links could help publicise the open data portals, and, at the least, increase the likelihood of usage.

Country case: Ghana

"We have resolved to ensure that government data is legally and technically open. Open data will encourage citizens to hold government accountable and ensure greater transparency. Open data must work in Ghana to the benefit of the citizenry" H. E. President Akuffo-Addo (ADRR2016)

Ghana's open data ecosystem

Open data in Ghana can be traced to late 2011 when the country joined the Open Government Partnership (OGP). In a synergistic development Ghana's Open Data Initiative (GODI) was initiated in January 2012 by Ghana's National Information Technology Agency (NITA) in partnership with the Web Foundation (WF). In line with relevant OGP thematic priorities, the vision of GODI was to make Government of Ghana data available to the public for re-use and to foster *"an open data community involving the Government of Ghana, civil society organizations, industry, developer communities, academia, media practitioners, and the citizenry, to interact with one another with the aim of developing an open data portal to bring about transparency, accountability and efficiency in government"*[112].

In August 2012, an Open Data Steering Committee was inaugurated to guide the activities of GODI. The committee included representatives from Cabinet, NITA, CSOs and the Ministry of Communication. GODI itself was officially launched in 2014. However, in this first phase, both funding and consistent stakeholder engagement were challenges. The guidance and leadership role expected to be given to GODI by the committee was effectively not realised because they met only twice after the inauguration. This affected the GODI, as the activities of the steering committee were equally important as funding provided by the World Bank Group (World Bank Group, 2015). The government was also not able to implement most of the OGP Action Plan (Ghana Statistical Service, 2017a).

Launched with 100 data sets in 2012, the GODI portal currently (as of 5th September 2018) contains 133 datasets from 25 different agencies. The largest dataset is from the Ministry of Food and Agriculture. Other datasets are from the Ministry of Local Government and Rural Development, the Ministry of Health, the Ministry of Finance and Ghana Statistical Service. The website provides the Open Data Commons Database License (ODbl) which enables free sharing, creating and modification of datasets but licenced for open data[113] .

In practice, GODI appears to have focused more on providing data and less on creating a community where citizens could access and use of available data (Ohemeng & Ofosu-Adarkwa, 2015). Moreover, data on the GODI platform (http://data.gov.gh/) are not necessarily up-to-date (Opoku, 2015). Empirical analysis as well as stakeholder insights point to specific challenges that may have contributed to the current status of the GODI platform.

"Our challenges are inadequate collaborations between government institutions, inadequate data sharing culture, data privacy, lack of legal framework, poor data quality and funding. Workshops and forums have been organized with the attempt of addressing these challenges, and we hope it yields good results." (Interview respondent)

The more recent momentum on OD appears to be driven by three key developments: an integrated and multi-stakeholder approach to data for the sustainable development goals (SDGs); Ghana's hosting of the 2nd Africa Open Data Conference (AODC) in July 2017[114] ; government support and new strategic partnerships. An SDG Data Roadmap Forum was co-organized by the Ghana Statistical Service (GSS) and the National Development Planning Commission (NDPC) in collaboration with the Global Partnership for Sustainable Development Data (GPSDD) and other partners in April 2017.[115] The forum adopted an ecosystem strengthening approach to enhance the engagement between

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[112] https://en.wikipedia.org/wiki/Ghana_Open_Data_Initiative

[113] https://opendatacommons.org/licenses/odbl/

[114] See Open data and information key to Africa's development – Akufo-Addo (21st July 2017) which underscored the resolve of government to ensure that "government data is legally and technically open, data released from all Ministries, Departments and Agencies, and Metropolitan, Municipal and District Assemblies are made available, and the use of open data is promoted within government and the open data ecosystem"... and more practically "... "Government will establish an Open Data Institute to promote education, management and use of open data, especially for the development of mobile and web-based applications".

[115] See GSS (5-6 April 2017) Report of the Ghana Data for Sustainable Development Roadmap Forum

data producers and data users. It encompassed a strong focus on open data as well as the legal and policy framework for data amongst others.

The report of the Data Roadmap Forum underscored the imperative for the country to redouble efforts to ensure that data producers commit to releasing data in a format which is easily reusable and interoperable. This is critical given the potential to increasingly tap into quality harmonized administrative data for over half of the SDG indicators, as opposed to relying only on major surveys which typically take place only every 4-5 years and are more expensive. In addition, there is the potential to deploy innovative methodologies to combine and integrate different types of data into official statistics, to amongst others, facilitate analysis of spatial patterns and to get new insights into drivers of progress and blockages[116] and improve communication and presentation of data to ensure data production supports evidence-based decision-making. The forum further identified key areas for action to improve data use. These include together all sides of the open data ecosystem; (iv) providing training and capacity building for all the segments; (iv) developing a strategy on open data and data analytics for the Government of Ghana to be incorporated into the medium-term strategy; (v) supporting the framework for the establishment of a Ghana Open Data Forum. The focus will be on four sectors of the economy, namely; agriculture and nutrition; health, energy and education.[117]

It is early days and the various components of the project are at various stages of implementation. An Open Data Readiness Assessment (ODRA) has been carried out but has not been finalized yet. Mobileweb Ghana (MWG, a mobile/web services company) and SBC4D (which specializes in Open Data training and ICT4D projects) were recently contracted to further develop and reboot the Ghana Open Data Portal. To this effect, a dialogue on further developing the Ghana Open Data Portal was initiated in July 2018.[118] An open data policy framework has been prepared and is expected to be discussed and validated over the coming months.

Ghana Open Data Initiative has also signed an MoU with TransGov Ghana which commits the two institutions "to share knowledge and expertise relating to Open Data in Ghana, utilise and leverage existing resources, collaborate on research and dissemination of good practices, provide policy guidance, boost collaboration with other entities, and jointly host seminars, workshops and training events to strengthen Ghanaian capacities for innovation in Open Data projects".[119]

real-time data production that is readily accessible to users, through a platform hosted at GSS.
The GSS is working with Office of National Statistics UK (ONS) on the development of Ghana's SDG indicator tracking platform that will provide open data on the SDG indicators. GSS itself has demonstrated leadership in already making its own data available in open and interoperable formats on its website. Going forward, there could be potential to link to the revamped GODI platform which serves as a repository for all open data and for key government entities and stakeholders to collaborate on encouraging effective data use and analysis.

In 2018, the Government indicated that it would apply part of the proceeds of the World Bank eTransform Ghana Project towards the development of the Open Data Platform, including (i) developing open data policy and legal framework (ii) upgrading the current open portal in line with international standards and best practice; (iii) developing content on open data using international best practice by bringing

"The challenge of open data from the perspective of GSS include accumulating timely, quality and relevant data from all government agencies (supply-side stakeholder). We have our own process of validating data before publishing it on the platform, and it starts right from validating the variables for gathering the data. […] Our process is different from the other government agencies, so it is difficult to trust the quality of the data produced by these agencies. For example, we once tried using data from the birth and death registry, and it lacked quality." (Interview respondents at GSS)

[116] See UNStats Presentation on a Research Exercise to Establish a Federated Information System for the SDGs on country-led "system of systems" to strengthen the role of NSOs in managing statistical and geospatial data, integrating new and innovative data sources with traditional ones and implemented through: an open data platform; GIS and data analytics capabilities; and web-based tools for communication and user engagement.

[117] See Ghana Public procurement authority (Jan 2018) Development of Open Data Platform for Ghana GODI portal to be functional in 2019 (July 31, 2017)

[118] See Ghana Open Data Portal Development – Stakeholders' Dialogue

[119] See Ghana Open Data Initiative signs MoU with TransGov Ghana (March 3, 2017)

Various other open data initiatives are underway, including by Mobileweb Ghana, Humanitarian OpenStreetMap Team (HOT) and OSM Ghana, which are pursuing the Open Cities Accra project with World Bank support.[120] Open Cities Accra requires remote mapping, assessing available government data and collection of geospatial data to aid in making Alogboshie and its environs resilient to flooding. The project will also involve the remote mapping of the Nima, Akweteman and Alajo neighbourhoods in the Accra Metropolitan district. Different development partners have been promoting open data (UN agencies, the World Bank, USAID, UK Aid amongst others).

Ghana is a member of the Global Partnership for Sustainable Development Data. The GPSDD has been working in a focused way with 8 countries—Ghana as well as Colombia, Costa Rica, Kenya, Philippines, Senegal, Sierra Leone, and Tanzania - to support their efforts to "build more robust multi-stakeholder data ecosystems at the national and sub-national levels." Ghana has effectively tapped into various partnerships to promote increased access to quality open and geospatial data, including through the Africa Regional Data Cube (ARDC). The ARDC was formed to better address the challenges of food security, agriculture, deforestation and access to water through using 17 years' worth of open earth observation and satellite imagery.[121]

Impact of open data in Ghana

This section focusses on a few areas where open data has been leveraged, namely: agriculture, elections, citizen participation, and data journalism, and gender equality.

Open data and agriculture

There is a growing focus on strengthening the contribution of agriculture to sustainable development in Ghana. To this effect, the Government's 'Planting for Food and Jobs', a flagship program, is expected to help the country achieve SDG 1 and 2 (MOFA, 2017). However, a review of data on crops in Ghana under the PFJ revealed its limited scope (USAID, 2016). Measuring progress towards achieving the SDGs on Zero Hunger (SDG 1) and No Poverty (SDG 2) are the major perceived impact of open data in Ghana. To this effect the data portal of Ghana has the majority of its data on agriculture which is downloadable and reusable.

"Access to data for decision-making and planning is a big challenge for the poorer northern part of the country. One of the things that UNDP Ghana did, in collaboration with the Kofi Annan Centre for ICT (AITI-KACE), was to help the regional development agency (i.e., SADA now NDA) to pull together key data and maps and to make these open and accessible through a one-stop shop. The proposed approach was to use APIs to tap into existing data which could be presented in a meaningful way – e.g., key survey data in collaboration with the GSS. Our focus is on promoting open data and interoperability and making data 'understandable' and useable, not just focusing on the numbers per se." (Radhika Lal, UNDP)

One of the insights underscored by the Meltwater Entrepreneurial School of Technology (MEST) is the importance of open data for underpinning the ecosystem for start-ups and tech companies to drive the development of innovative solutions to address key development challenges and the SDGs. "*Agri-tech companies can use agricultural census data to perform market research and develop corporate strategies; freely available, granular demographic information can enable all start-ups to better understand their users and their needs*"[122] . The niche for ICT in agriculture intermediaries such as Esoko and Farmerline, discussed below, emerged given the convergence of the following: a) rural small-scale farmers in need of certain types of information; b) government open data were available but not easily accessible and delivery via extension officers was constrained[123]; and c) mobile-phone technology

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[120] Open Cities Africa is part of the World Bank's *Global Facility for Disaster Reduction and Recovery (GFDRR)* OpenDRI (Open Data for Resilience Initiative) program. It engages local government, civil society, and the private sector across ten cities in Africa (including Accra) to map public infrastructure data in growing urban environments. Each city has a local partner working alongside city government officials to map public infrastructure using OpenStreetMap and its ecosystem of open source tools.

[121] See New satellite technology tool transforms ability to manage food security in five African countries (March 20, 2018). The ARDC is based on the Open Data Cube (ODC) infrastructure which allows analysis-ready satellite data (e.g. Landsat, Sentinel) to be used for efficient time series analyses, e.g. land change, water extent and quality, agriculture extent and health etc..

[122] "MEST Attends Ghana Open Data Portal Development Stakeholders' Dialogue" (August 6th, 2018); on the importance and the role of intermediaries, see (Andrason & Van Schalkwyk, 2016) which points to how open data is complemented by data and processing by the intermediaries. The paper includes a discussion of Esoko and Farmerline. Farmerline sources open data from the government's meteorological services (GMET) and from the Ministry of Food and Agriculture and combines it with data collected by Farmerline (i.e., the company's own agents collect weekly market prices); agricultural advice information for farmers is sourced mainly from open sources such as MoFA, KNUST and Farmerline actively contributes to the preparation of this type of information. Financial advice is mainly generated by Farmerline and is sourced from microfinance institutions.

[123] MoFA has also been working on strengthening the delivery of its open data and services through mobile telephony.

became inexpensive and widespread (Andrason & Van Schalkwyk, 2016).

The **Vodafone Farmers Club** was created by Vodafone Ghana to leverage open data for bridging the gap between farmers and extension officers. This innovation is important as respondents of this report noted the scrapping of the role of extension officers and the need to reach rural farmers through data driven-tech innovations. The Vodafone Farmers Club is aimed at providing a real-time solution to farmers at a low cost of GH¢2 a month. As noted by some of the respondents:

> *"Open data is not only about the format but making data available to those who need it in any format possible at low cost. That is how the impact of open data can be attained and increased in the country. There is, therefore, a need for different models and technologies that can make data accessible, usable and beneficial to citizens." (Radhika Lal, UNDP)*

An example of open data impact was the mitigation of the devastating impact of the fall armyworm on agriculture in Ghana. A huge amount of agriculture produce was lost to this worm in 2018. However, the opening up data on the fall armyworm led to the invention of a technology-based solution developed by (non-Ghanaian) students intended to reduce the effect of fall armyworms in Ghana. This solution enabled farmers to easily identify fall armyworms via technology, by taking pictures upon discovery of any strange worm on their farm. The picture is analysed by the software and feedback is sent to the farmer in real-time[124].

Famerline is a Ghanaian Technology provider which uses SMS to provide data-driven solutions aimed at empowering small-scale farmers in Ghana. This is achieved through the use of mobile generated data from both primary and secondary sources. Farmerline is grounded on the perspective of a social enterprise that seeks to provide smallholder farmers with simple mobile technology solutions and real-time data through aggregation and disaggregation of open data on agriculture. The company helps farmers prevent post-harvest losses and regular low yields due to lack of knowledge on market prices. The company initiated the Apps4Ag that provides training on data collection apps for agriculture and rural projects and tools for improved information access for smallholder farmers. The impact of Farmerline's activities is its ability to contribute to bridging the illiteracy gap and poor internet connectivity through open data. This is evident in the type of services they provide which includes outbound messaging to provide personalised voice alerts that communicate critical information on aggregated market prices, farming techniques and weather forecast; as well as mobile surveys that capture the impact of interventions of farmer-driven associations.

The content messages and mobile surveys provided by Farmerline are offered via SMS and Android apps. It has over 200,000 users across West Africa. Farmerline's MERGDATA survey and CocoalLink apps, for instance, have over 1000 downloads on Google Play Store. In order to bridge the literacy gap, Farmerline also provides farmers with voice-based messages.

Esoko is another mobile service organisation aimed at responding to farmers needs in Ghana through mobile technology. Esoko provides customised services such as SMS based market price, weather alerts, crop advice and bridging the gap between sellers and buyers in local languages. This is achieved by leveraging smartphones and tablet devices to collect agriculture data in real-time. The organisation developed Insyt, a real-time data collection tool which became the pillar for some government intervention programs, for example, the Livelihood Impact Empowerment Against Poverty (LEAP). With the aid of Insyt, Esoko was able to profile 150,000 poor households in 50 districts across the ten regions in Ghana in real-time. Esoko is now extending its presence into other African countries. Though Esoko has been praised for its flagship programmes, the company has also received critique for the financial sustainability of its business model (Vota, 2018). Nevertheless, many considered Esoko to be the leading example of a scaled m-agri solution (Miller-Wise, 2017). Based on the above, Esoko can be considered a public-private partnership with government. As noted by Vota (2018), Esoko invented the apps Insyt to enhance partnership with government ministries and Tulaa to enhance m-commerce for farmers.

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[124] Wisdom, Africa Open Data and Internet Research Foundation (AODIRF), http://www.aodirf.org. The objectives are to carry out open data and internet research, provide training and build the capacity of targeted individual and institution and support innovative projects and programs across Africa; for a focus on open data tech solutions to fall army work crisis. Also see What's the Place of Technology in the Fall Armyworm Crisis? (April 17, 2018)

Transforming Rural Agricultural Communities through Organic Re-engineering (TRACTOR) is an NGO aimed at promoting food security and rural livelihood improvement. TRACTOR leverages modern farming technological innovations to improve the knowledge of farmers in indigenous farming techniques. As noted on their website: access to accurate and timely information is crucial in increasing agricultural production (TRACTOR, 2014). The company has an agricultural ICT centre that specialises in research, analysis and documentation. The findings are communicated to the farmers in their local languages. The ICT centre is used as a platform to gather real-time data and disseminate aggregated and disaggregated data to farmers. The ICT centre is also used to promote ICT literacy among farmers, provision of training on agricultural business management and good agricultural practices via technology.

Open data and elections

Election data in Ghana is made publicly available to the media by the Electoral Commission. Prior to the election, the Electoral Commission conducted awareness programmes for citizens. The voters register is publicly opened for citizens to verify their names and polling stations. "Opening" of the voters register also allows the various political parties to know the number of citizens who are valid voters and possibly make forecasts. Technology was used alongside the paper-based register for the 2016 election. Ghanaian citizens could electronically check if they were considered "valid voters". After the election, ballot papers were publicly counted and telecasted live.

One impact of open data in Ghana relates to the questioning of the "validity" of the December 2012 general presidential election result. The "validity" of the results was questioned based on the biometric verification and involvement of a technology company to cumulate the results. Inconsistencies with unique identifiers assigned to polling stations and declaration forms were also uncovered. The numbers of voters prior to (14,031,680) and after (14,158,890) the election were disputed (Asante & Asare, 2016). The election petition process gave rise to a number of changes that affected the 2016 general election. The changes include continuous voter registration; use of Biometric Verification Devices and Automated checking of voters register; automated transmission of the election results from the various polling stations to the Electoral Commission's data centre, the institution of an accessible, open and transparent National Results Collation Centre to replace the "strong room" and the publication of the presidential election results from individual polling stations on the website of the Electoral Commission.

Citizen participation

This section discusses the impact of open data on citizen participation in Ghana, highlighting two NGOs namely Odekro and GINKS **Odekro** is a civil society group with an aim of empowering citizens through open, real-time data from Parliament and other sources. Odekro provides live telecasts of the Parliament proceedings. By leveraging open data, Odekro has created reports on parliamentarians' absenteeism, corruption and how parliamentarians in Ghana use social media. For instance, in June 2018, Odekro released a report on the cost incurred as a result of parliamentarian absenteeism. The report revealed that this behaviour cost the country about ¢1.4 million (US$300,000). Fifty-four Members of Parliament (MPs) during the data collection period violated the Constitution by absenting themselves from Parliament without permission: Overall 54 MPs reached and crossed the 15 sittings absence threshold without permission, thus violating Article 97 (1) (c) of the 1992 Constitution of Ghana, *"since there is no there is no material evidence that they sought permission in writing form the Speaker"* (Odekro and Wisdom-NITA). Its crowdsourcing aspect is where it conducts Facebook polls, such as prior to Public Budget releases, to raise awareness about the upcoming budgets and also to inform policymakers about the citizen expectations.

The **Ghana International Network for Knowledge Sharing (GINKS)** aims at alleviating poverty with the aid of ICTs, information and knowledge sharing among all stakeholders (Ahiabenu, 2007). GINKS also aims at making ICT accessible to all Ghanaians while addressing the challenges within the ICT environment in Ghana. GINKS has organised various training programs for civil servants including parliamentarians in Ghana. For example, in 2015 an Evidence-Informed Policy Making training course was organised for civil servants in Ghana to enable them to deal with policy formulation and public interest challenges. A follow-up showed that the skills of participants had improved in areas of assessing evidence/information sources, contribution to policy documents and communication. One of the participants was able to develop an information

request form for front desk personnel to enable them to regulate and clarify information requests (Jotie, 2016). Another workshop was organised by GINKS and the African Centre for Parliamentary Affairs (ACEPA) with support from the International Network for the Availability of Scientific Publications (INASP) for information support staff of Parliament. This training was aimed at practically *"helping parliamentary staff understand the factors affecting evidence in the various departments of Parliament and approaches to handling these issues"* (GINKS).

Open data and gender equality

The enormous potential of open data is yet to be realised in Ghana, especially relating to gender equality. Ghana Statistical Service (GSS) has outlined a focus on gender sensitive data (Goal 5) envisaged by disaggregating data by sex and highlighting gender related challenges such as domestic violence and unpaid labour (mostly by women) (Ghana Statistical Service, 2017b). There are also some indicators providing data for SDGs 1, 3 and 11. A draft 5-year statistical plan has been produced which outlines a strategy and implementation plan to improve gender statistics in Ghana, and GSS is engaging with partners on a project to use innovative technologies to collect gender data.

The World Wide Web Foundation's 2018 report mentioned the gap between open data and women empowerment in Sub-Saharan Africa and noted the potential of leveraging open data to address the issue of gender inequality (Brandusescu and Nwakanma, 2018). Issues such as economic inequality manifested in unpaid labour and salary gap were mentioned as some of the causative factors that prevent women from engaging online and interacting with available data. Other challenges mentioned were cultural beliefs, digital divide and poverty.

Digital inequality in Ghana is pervasive. The extent of this inequality is most evident as some newspaper reports refer to Ghanaian women in technology as women who have *"dared to tread on unstable waters"*. However, some women successfully lead technology organisations in Ghana including Nandi Mobile, EDEL Technology Consulting, Soronko Solutions and Logiciel. Some of these women-led IT firms are providing educational programs on technology to women in Ghana to equip them with the skills and knowledge to engage with open data and interact on the Internet. Soronko Solutions for instance organized in October 2017 a training program dubbed 'Tech Needs Girls Coding Class', targeted at demystifying the myth that technology cannot be *"touched by girls"*.

The **Energy Sector Management Assistance Program (ESMAP)** is helping women from selected rural fishing and farming communities in Ghana to participate in issues relating to energy security, renewable energy, energy-poverty and market efficiency and governance. Ghana also has the Women's Situation Room (WSR), established by UNDP with technical support from The Angela Brooks International Centre (ABIC) and funded by various international agencies. WSR is led by Ghanaian women and has the aim of mobilising women to participate actively in the democratic electoral processes. There is no strong base of research for women's access and use of open data. The private sector and civil societies alike must address the opportunities for women to access and use open data for their benefit.

Data journalism

Although data journalism is considered to still be at the infancy stage in Ghana, the concept and practice are gradually gaining grounds, especially after Ghana's inclusion in the OGP initiative. In 2012, GODI introduced a data and digital skills training session targeted at data journalists under the theme of "Elections and Civic Watchdogs Media using Open Data". Later in October 2012, the National Information Technology Agency (NITA) organised a three-day Data Journalism Boot Camp to train Ghanaian journalists on how to use open data. A further two-day training was organised by Canadian volunteers and journalists for Human Right trainers equipping about ten journalists from the various Ghanaian media outlets to help them disseminate stories that are based on accurate open data.

The African Media Initiative, Mobile Web Ghana and the World Wide Web Foundation launched the Code for Ghana initiative in 2015. Code for Ghana was aimed at forming a community of civic inclined technology and open data professionals. These professionals were attached to media houses in Ghana to drive data journalism. Code for Ghana also aims to create a movement helping citizens to use open data.

In 2014, another training forum on open data in journalism was organised by the International Institute of ICT Journalism with support from

STARGhana in the Volta Region. The theme for the forum was "Open Ghana-Data Journalism for Improved Maternal Healthcare Delivery". Its objective was to create a collaborative engagement platform for journalists, health officials and other key stakeholders, to help mitigate maternal mortality. A case study was targeted at four densely populated areas in the Volta Region; namely Ho, Hohoe, Kpando and South Dayi.

In February 2015, the National Resource and Governance Institute and the International Institute of ICT Journalism (Penplusbytes, 2015), introduced Data Dive. Data Dive was a three-day course aimed at building the capacity of the Institute's alumni in story production in the extractive sector. The theme was: 'Drilling Down: Ghana extractives data dive". Supported by Omidyar Network, the initiative was part of the Institute's CODEX (Catalyzing Open Data for EXtractives) project. It was designed to expand the use of extractive industry data to increase relationships between extractive revenues and outcomes targeted at human development.

Data journalism efforts in Ghana are being recognized internationally. In 2018 data journalists from multimedia Group Limited in Ghana were awarded for various projects (Media Foundation for West Africa, 2018). A data journalism driven collaboration between JHR, Voto Mobile, CitiFM and The Weekend Ghana, using social media discussions and mobile based poll data in local languages, revealed that about 46% of Ghanaians had engaged in paying bribes for government services (JHR, 2013). Data journalism in Ghana, however, faces specific challenges. These include communication beyond data (numbers) to storytelling based on disaggregated and visual data (Penplusbytes, 2015). Other data journalism challenges in Ghana as posited by Ahiabenu (2017) are:

- Access to structured and machine-readable data is limited. An example was the lack of access to data from the Ghana Health Service during the Ebola outbreak in 2014. Available data is mostly in the form of paper-based-documents or pdfs.
- Data journalists are not being empowered due to the lack of legal framework (Right to Information Act).
- Most media houses lack the human resources to undertake the time consuming and demand driven investigative nature of data journalism. Data journalism goes beyond news rooms to the acquisition of the required skills in computer programming, visualisation, mathematics etc.

Findings and recommendations

The above showed that various open data stakeholders had initiated projects to ensure that open data benefits Ghanaians. However, there is a need to critically educate the supply-side, i.e. GODI actors, about the relevance and importance of open data, going beyond mere statistical figures.
This report also suggests that in order to adequately attain the SDGs via open data there is a need for more intermediaries. These intermediaries act as *"creators of value positioned between data providers and users"* (van Schalkwyk et al, 2015). These intermediaries are essential when there exists a high level of interdependency by multiple stakeholders within complex systems which results in the need for "infomediary business models" (Janssen & Zuiderwijk, 2014). *"Once people start getting data in formats that are user-friendly, accessible and visual, it can change perceptions, facilitate discussions on the actual trends, which are sometimes hard to know when we just look at tables, and people do not always make an economic analysis of the descriptions of the data"* (Radhika-UNDP, Mica-FAO).

There is also a need to go beyond a focus on portals with datasets to actively promote engagement between the producers and users of data and for collaborations between both supply and demand sides of GODI. If there is no demand and stakeholder engagement and no supportive enabling environment, there is likely to be no incentive to change institutional behaviour to facilitate provision of open data as well as to tackle the challenge of data quality. Collaboration in open data has been discussed as essential in the process of integration and information sharing (Choi et al, 2014). Thus, pertaining to open data publication and use, there is a need to implement adequate coordination mechanisms due to the complexity, multi-stakeholder involvement and lack of current engagement structure in Ghana's Open Data space (Zuiderwijk & Janssen, 2013). An agreed-upon framework should be drawn that has the potential of increasing data quality and usability from a multi-stakeholder perspective.

The following, therefore, provides some recommendations for GODI:

- There is a need to involve the software developers who should be trained on using

data to develop apps that can help Ghanaians. This can be done through increasing hackathons that are competitive in nature and well-funded to make the applications more scalable, cheap and user-friendly: *"I will say the community is not [engaging sufficiently, especially not] the developer communities (tech guys). Here and there we should see them using available data, playing with the data to produce software. We need to bring them on board; I think this can be achieved by organising hackathons in the form of competitions. This should be funded so that the winner can develop the application at a low cost."* (Wisdom-NITA, data journalist). For example, tech and non-tech organisations should collaborate in order to bridge the gap between them through the use of open data.

- Also, events like data "equity walk" training and interactive workshops can be organised on open data in Ghana. The data "equity walk" can be used to help Ghanaians understand and interact with data on health, agriculture, elections, education, etc. It should be tailored to be an all-inclusive event. Thus its participants should be not only those who have prior knowledge on open data but also subject domain specialists that have not worked with open data before; this will create awareness and increase the impact of open data in Ghana.
- There is a need for commitments and collaborations from all the stakeholders within the GODI ecosystem, to develop an acceptable framework for publishable data in Ghana. This will increase multi-stakeholder discussions on GODI and thus increase the impact of open data.
- There is a need for more and diverse empirically grounded academic research on GODI, in order to have an independent view on the developments around open data in Ghana.
- The Right to Information Bill also needs to be passed into law as it may contribute to increasing the publishing of more open data.
- The aspects around licensing and reusability of open data merits further discussion among the Ghanaian open data stakeholders.
- This report also recommends that the various NGO's in Ghana who collect real-time data as a result of their activities for various communities should consider making it open.

Country case: Rwanda

Country context

The Republic of Rwanda is a landlocked country in East Africa with one of the highest population densities in Africa and a current population estimate of 12.5 million. The population is comprised of three ethnic groups, the Hutu (84%), Tutsi (15%) and Twa (1%) people. Since the genocide in 1994, Rwanda's political situation has been relatively stable with strong economic growth accompanied by improvements in the standard of living and almost universal primary school enrolment. Rwanda met most of the Millennium Development Goals in 2015, but the road ahead for achieving the Sustainable Development Goals is challenging.

Vision 2020 lays out a detailed strategy of Rwanda to transform the country from an aid-dependent, agrarian-based low-income economy to service-oriented with a robust private sector middle-income economy by 2020. The use of ICT is incorporated in all the national strategic development programs with an intention to attain 100% government digital transformation with a focus on big data and analytics.

Rwanda released the national Data Revolution Policy (DRP) in 2017 which stresses the significance of OGD to contribute to socio-economic benefits, informed policy decision making, enhancing transparency and promoting citizen participation, monitoring the SDGs, supporting research and development, and innovation for data-enabled applications.

The Rwanda Demographic and Health Survey 2014-15 (2014-15 RDHS) was conducted by the National Institute of Statistics of Rwanda (NISR) from November 2014 to April 2015. A fairly detailed survey report is available for open access on NISR's website. The survey report includes roughly all the key health indicators in line with the SDGs. Though Rwanda's food and nutrition policy and National Health sector policy were revised in 2014-15 (before the SDGs were formulated), the indicators are largely aligned with the SDGs. Along with health, datasets are available for a majority of the SDGs on NISR's website and are frequently updated. NISR along with Ministry of Health and other ministries have Civil Registration and Vital Statistics Systems (CRVS), a web-based application system for recording vital events in order to boost quality and coverage in data capture and management of vital statistics.

Open data impact in Rwanda

This case study reviews the state of the open data in Rwanda from two angles: Rwanda's performance on GovLab's impact analysis framework, and the assessment of demand and supply sides of open data in Rwanda. Verhulst and Young of GovLab, New York University pioneered a fresh approach to evaluating open data impact and categorised open data's (intended or realised) impact on development along the following pathways or categories in their "open data in Developing Economies[125] " study.

Creating opportunity:

Rwanda is ambitiously aiming to create 1.5 million jobs by 2024 with a focus on sectors such as infrastructure, services, tourism, agriculture, construction, ICT, and mining[126] . Though ICT continues to be a core focus area for the government to spur economic growth and create employment and the emergence of multiple ICT based start-ups paints an optimistic picture, there is no clear evidence that open data has created an economic impact. This can be linked to a larger narrative in Africa where the use of open data is primarily being promoted to increase accountability in governance. Because of that narrative, potential economic benefits of open data are largely overlooked.

Solving public problems:

The power of open data is not yet realised at the grassroots level in Rwanda. There is no concrete research which indicates whether or not citizens are aware of the policies and potential of open data. A large part of the debate is restricted to the government and multilateral organisations such as World Bank, UNDP, etc. Secondary research across the web, media, and academia show no signs of citizens' awareness of open data.

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[125] http://odimpact.org/files/odimpact-developing-economies.pdf

[126] According to the government's 7-year programme http://gov.rw/news-detail/?tx_ttnews%5Btt_news%5D=1830&cHash=7810e25ea08520037f351752ee44f8cf

A team of Youth Mappers network at INES-Ruhengeri, Rwanda created open data for the Kangondo Slum neighbourhood in the city of Kigali, Rwanda. The Kangondo slum is among largest slums in Kigali, Rwanda. The community faces complex challenges such as unavailability of potable water, inadequate sanitation and sewage. The created open data will be used for the marginal neighbourhood improvement process (Slum upgrading). This activity was a good opportunity to share not only the importance of open data in the development of the local community with attending authorities, but also a time to discuss the use of open data to address local development challenges.

Improving governance:

Between July and August 2013, an Open Data Readiness Assessment ('ODRA') was conducted for a sample of 15 organizations, including Government and private sector. A SWOT analysis of the data environment in Rwanda was undertaken and the exercise identified several strong opportunity factors which could be leveraged to promote development of a data ecosystem in Rwanda[127]. However, the government's accountability specifically with respect to citizens that can be attributed to open data is not visible in media reports and elections.

The impact of open data is evident in increased information sharing and service delivery in Rwanda. Rwanda Development Board (RDB) was set up by bringing together all the government agencies responsible for the entire investor experience under one roof. All the agencies share data and information to boost investment and business tourism. A World Bank Group advisory project helped to set up a Convention Bureau under RDB, which improved the Government's capacity to identify business opportunities in the meetings, incentives, conferences, and events (MICE) sector and created an avenue for private operators to secure convention business opportunities. After the Rwanda Convention Bureau was established, visitors for conferences nearly doubled from 17,950 to 35,100 and revenue from MICE events increased from US$29.6 million in 2014 to US$47 million in 2016[128].

"The Rwandan Government recently, as part of its e-government programme, initiated a service where citizens can address any of their complaints to any ministry or other government institutions using their cell phones by sending a text message to a toll-free number. However, the data is not available about the number of complaints addressed"[129].

An area where OGD has particularly helped service delivery in Rwanda is a digitised land registration system. Through a web portal (www.irembo.gov.rw), it is possible to make an online sale or subdivision of land. The government efficiently tracks the land use data using spatial mapping, and the online portal makes the process much quicker. With the current system in place, it takes only three days to process a land title as compared to a one-month period previously[130]. The accessibility of land-use data and the ease of registration may have a positive impact not only on reducing income inequality but also gender equality. While a number of case studies and research papers talk about the impact of land reforms on gender equality in Rwanda[131,132], there is an opportunity to investigate the impact of ICT driven land registration process and to open the land-use data on augmenting access to land for women in Rwanda.

Empowering citizens:

Using OGD to digitise the government services certainly helps improve decision-making capacity and choice. Along with land registration, Irembo[133] portal allows other vital services online such as driving license registration, tourist permits, NGO registration, etc., making the citizens more informed about the government services.

However, there is little or no evidence that open data has augmented social mobilisation in Rwanda or has informed advocacy efforts. The effective use of OGD and digitisation is in line with the Government's efforts

[127] Refer to Rwanda's National Data Revolution Policy (April 2017) Available from: http://statistics.gov.rw/file/5410/download?token=r0nXaTAv

[128] Result Briefs: Expanding Business Tourism in Rwanda https://www.worldbank.org/en/results/2017/07/06/expanding-business-tourism-in-rwanda

[129] http://www.newtimes.co.rw/section/read/229668

[130] Land Reform in Rwanda: Center for Public Impact Case Study https://www.centreforpublicimpact.org/case-study/land-reform-rwanda/

[131] Procuring Meaningful Land Rights for the Women of Rwanda - Aparna Polavarapu

[132] Impact of the Land Reform on the Land Rights and Economic Poverty Reduction of the Majority Rural Especially Women Who Depend on Land for their Livelihood

[133] The Kinyarwanda word Irembo is synonymous with Access, Service and Openness. Irembo is the one-stop portal for e-Government services.

to curb corruption and consequent improvement in Rwanda's ranking on the global Corruption Perception Index[134]. There is, however, little evidence from the media or elections that the use of open data has increased Government's accountability to its citizens.

Analysis of the demand and supply side of open data

Supply of open data

The initial focus of multilateral organisations was to ensure that governments in the developing economies make accessible specific data such as census, land ownership, government budgeting and spending data along with data for development indicators like education, health, and environment.

The Government of Rwanda responded swiftly to the Open Data Readiness Assessment (ODRA) done by a World Bank team in 2013.

As a result of ODRA recommendations, huge government data repositories are now available for open access on the NISR portal. Data includes the complete census data, consumer price index (CPI) data, geospatial data and the data from numerous surveys focusing on three distinct categories, "Economy, Agriculture & Infrastructure", "Education, Labor and Justice" and, "Population, Health and Poverty." The quality of data is commendable and broadly in line with the six principles of the Open Data Charter, although Rwanda has not officially adopted it. Since the open data is at a very nascent stage in Rwanda, the majority of the supply side is restricted to government data itself.

"When we talk about open data, it is important to draw a distinction between statistics or statistical datasets and open data. Open data follows a lifecycle from a dataset to analysis of data, disseminating insights and eventually evidence-based decision making. Talking about Rwanda, the supply side of the government data is strong – good quality data is frequently being published on the major socio-economic indicators, but the demand side is certainly weak. Currently, there seems to be no dialogue between the supply side (primarily government) and the demand side (private sector, CSOs, academia) in Rwanda. Unless both sides come together and collaborate, the impact of open data in Rwanda won't emerge."
Claude Migisha, ICT4D Expert, Founder of Sabanukirwa.rw.

Demand for and use of open data

The demand side of open data includes NGOs and interest groups, researchers and academia, journalists and media outlets, donor organizations, private sector — entrepreneurs and corporations, and government officials.

NGOs and Interest Groups

An analysis of country websites and project/ interventions of five big international non-profit organisations in Rwanda reveals that they frequently access the NISR data to understand the landscape and address issues at the grassroots level[136]. However, whether or not the organisations plan or modify their interventions and projects based on the open data they access is a question still left unanswered. Two organisations that stand out and whose work can be directly attributed to open data include:

- **Transparency International** analysed the Auditor General's published reports of the decentralised entities for the fiscal year that ended 30th June 2016 and provided recommendations to the Ministry of Local Government (MINALOC)[137].

- **Innovations for Poverty Action** evaluated a community-based environmental health

Awareness in scientific domain for the use of data is beginning to emerge in Rwanda. A research focus on "Utilization of online bibliographic databases by medical doctors in a teaching hospital in Rwanda" concluded that physicians at University Teaching Hospital of Kigali use online bibliographic databases to guide treatment and Medline/Pubmed are the most used databases. Nevertheless, there is gap in advanced searching skills among physicians. In terms of infrastructures the quality of internet bandwidth is another challenge. The study recommends continued sessions for literature search, as it is a key to practicing evidence-based medicine. It also recommends ensuring full access to scientific papers as well as good internet service delivery. [138]

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[134] Rwanda alongside Mauritius is 3rd least corrupt country in sub-Saharan Africa on the 2017 index, https://www.transparency.org/country/RWA. This report cites "President Paul Kagame's strict enforcement of compliance with the leadership code" as an example of a strategy that understands what works best in the country.

[135] https://opendatacharter.net/principles/

[136] Organizations Researched: Care International (http://www.care.org/country/rwanda); Save the Children (https://rwanda.savethechildren.net/); World Food Program (http://www1.wfp.org/countries/rwanda) ; Doctors without borders (https://www.msf.org.za/about-us/where-we-work/rwanda); World Vision (https://www.wvi.org/rwanda)

[137] https://tirwanda.org/IMG/pdf/agr_report_2018.pdf

[138] https://www.ajol.info/index.php/rjmhs/article/view/174704

promotion program in Rwanda using a randomised evaluation. Recommendations from the data-driven study were used by the Ministry of Health, Rwanda to scale Community Health Clubs program of the Government[139]

Research and academia

Rwanda has achieved tremendous success in increasing access to primary, secondary, and higher education over the last two decades but the focus on academic research is in a very early stage. The majority of the research about Rwanda is visible in international universities and think-tanks. Some organisations who stood out are:

- *The Institute of Policy Analysis and Research-Rwanda (IPAR-Rwanda),* a leading thinktank in Rwanda published multiple reports and policy briefs using OGD such as "Annual Analysis of Rwanda's Agriculture Budget Expenditure 2015-2016", "Rwanda Case Study on Economic Transformation", "Lifestyle and Sexual and Reproductive Health in Rwanda", and "Policy Brief on the Analysis of 2013/2014 Rwanda National Budget."
- The *University of Rwanda* is the only leading public university in Rwanda. A desk analysis of 51 scientific papers published by the university and available on its website between the year 2000 and 2013 reveals that only two published studies used open data in the last eight years[140]. Since the debate about open data picked up only after ODRA in 2013 in Rwanda, it is not possible to assess the impact of open data in academic research as there is no information about research done by the university post-2013 on the website or in the university's journal. A further investigation with the Department of Research at the University of Rwanda could shed light on the use and impact of open data in academia in Rwanda.
- *Carnegie Mellon University (CMU) Africa in Rwanda,* a campus of the renowned research university in the United States, was established in 2011. It offers world-class ICT and IOT expertise with a focus on initiating relevant research projects in Africa. The university has published 85+ studies in fields such as Blockchain, Internet of Things, Artificial Intelligence, Big Data and others. Although the details about the use of open data are not available on CMU's website, an analysis of the CMU's published work concerning the use of open data could uncover the potential impact. Overall, CMU in Rwanda could spearhead the use of open data in academia.

Journalists and Media Outlets

Journalism in Rwanda has historically been suppressed by the state and was constrained through lack of freedom[141]. However, data journalism is being embraced by the Government specifically to showcase the country's socio-economic development. In December 2017, NISR announced the winners of Rwanda Data Journalism awards. The winning stories[142] displayed the use of open data in four categories of media, TV, Print, Radio, and Online and reflected the Government's intention to promote data journalism. However, having NISR, a state-run department, initiate data journalism awards also raises questions about the Government's involvement in journalism and trying to control the facets of media.

Private Sector & Social Enterprises

While Rwanda is highly visible in the start-up revolution in Africa, there are very few organisations that are using open data as a business model. Of the 58 Rwanda start-ups listed on angel.co, the majority are ICT based organisations, but from a surface analysis, none of them appears to use open data as a core element of their innovation. This may point towards the lack of awareness about the use of open data in the technology space in Rwanda. Still, a few national and international organisations which use open data or promote its use have surfaced in the past few years.

- **Tumenye-Rwanda,** a civic technology organisation building digital tools to help citizens in Rwanda, created Sobanukirwa.rw, an access to information website materialising the open data revolution policy. Sobanukirwa directs requests to 617 authorities covering all the major government departments. Since 2015, 179 requests have been raised by the citizens of which 25 are answered, 148 are

[139] https://www.poverty-action.org/study/evaluation-community-based-environmental-health-promotion-program-rwanda
[140] http://research.ur.ac.rw/?q=node/54
[141] http://africanarguments.org/2016/01/15/exposing-rwandas-war-on-journalism/
[142] http://statistics.gov.rw/press/news/winners-announced-2018-rwanda-data-journalism-awards-rdja

unresolved, and 6 are unsuccessful implying, that the information does not exist. The low volume of requests (averaging only one per week) and the huge proportion (82.7%) of unresolved requests, indicates that something is amiss: there appears to be a lack of awareness or a lack of trust from the citizens, and a lack of willingness or capacity to respond from the authorities.

• **ESRI-Rwanda** Inc. has been the leading developer of geographic information systems (GIS) software globally. Since 2011, ESRI Rwanda has used its flagship ArcGIS product for collecting points of interest about accommodation, shopping, tourism and transport, cooperatives, restaurants, landmarks, monuments etc. The database now contains more than 4800 points in Rwanda with a special focus on the City of Kigali. The Data Layer is also publicly available[143] . Data collection continues, and the database is updated on a regular basis. Furthermore, the database provides access to the official school inventory, districts, sector and cell boundaries of Rwanda by the National Institute of Statistics NISR.

• insight2impact (i2i) is a global resource centre that seeks to improve financial inclusion through the smarter use of data. Using its national survey methodology, insight2impact did a detailed analysis about financial services update, savings, credit, level of education and sources of income in Rwanda. Its dataset and smart infographics are available on the i2i portal[144].

Critical assessment:

Lee and Kwak (2011) proposed a stage model to guide government agencies on their journey to open government. They argued that the implementation of OGD initiatives should be incremental and presented four stages of implementation to conceive government data as fully open.

- Stage 1: Increasing data transparency.
- Stage 2: Improving open participation.
- Stage 3:Enhancing open collaboration.
- Stage 4:Realizingubiquitous engagement.

Rwanda has undoubtedly crossed stage one. The Data Revolution Policy which came out in 2017 shows the Government's commitment to improving transparency efforts. NISR's publications across the major development indicators also raise confidence on the part of the Government to use data as a key to development. Still, the big part of the open data debate is restricted to government agencies in Rwanda. There are insufficient efforts by the Government to create awareness about open data and to initiate a dialogue among various stakeholders. Much of the demand side of the open data ecosystem is siloed with a little evidence of partnerships among the stakeholders. Since the collaborative environment does not exist in the civil society, private sector and government, citizen awareness and mobilisation is very low. Media's participation to inform citizens is nascent and focused on the success stories of the Government. While the Data Revolution Policy of Rwanda stresses the role of data to achieve overall economic growth, the policy doesn't have well-defined performance metrics to measure the success of open data initiatives.

"The key to unfold[ing] the unrealized impact of open data and data in general in Rwanda is the investment in the private sector. As a first step, the World Bank and other multilateral organizations rightly invested to create a government infrastructure for open data and data-driven policy making. But unless the private sector and social enterprises pick up the lead, innovation won't thrive. Government and international aid organizations have to do more to bring all the stakeholders, Civil Society Organizations, Private Sector, and Government Departments at the table and a create a collaborative environment." Steve Shema, founder of Exuus ltd, a data analysis company that designs financial technology (fintech) products.

[143] http://www.arcgis.com/home/item.html?id=8308c9ac45c84a579824d5e92491e951
[144] http://i2ifacility.org/data-portal/RWA/2016

Country Case: Burkina Faso

Status of Open Government Data

Main initiatives

In 2013, the Burkina Open Data Initiative (BODI) was created by the National Agency for the Promotion of ICT (ANPTIC)[145]. The Burkina Open Data Initiative (BODI) currently has 380 datasets[146] publicly available, although some are quite old and not all are 'useful' or valuable. Off-shoots initiatives from BODI are Carteau which plots water points geographically, Nendo which maps urban schools, and Vimap (for visualizing public accounts i.e. how the government budget is allocated)[147].

In 2015 the Open Elections project was initiated[148]. This remains the poster child and incontestable success story of open data impact in Burkina Faso, if not West Africa.

"We often think that it is the economic arguments that will make open data sustainable and give programs longevity. However, the experience so far in Burkina Faso's transition suggests that emphasizing transparency at a time of transition can cement buy-in in two ways. The first is that transparency is usually a good strategy for signifying a change to business as usual, especially in contexts where trust is low. The second is that a transition is a good time to push for transparency, at least in the immediate term" (Carolan, 2015).

Then again, a lesson might be that tapping into the current political trend or catching the zeitgeist is a good way to stay relevant, and for open data initiatives to thrive in the context of political transition.

In 2016, Burkina joined the OGP and, in 2017, it made two commitments: to have at least 500 datasets published as open data (they claim to have already achieved this, although only 380 datasets are listed on data.gov.bf) and to enact their Access to Information Act into law.

Since 2017, Burkina hosted and chaired the first Francophone Africa Conference on Open Data (CAFDO) with representatives from 22 francophone countries. Not much progress was made on the promises, but in August 2018, five projects initiated by CAFDO stakeholders were shortlisted for funding by the IDRC and other international collaborators.
In early 2018, the E-Burkina initiative, Burkina Faso's e-Government project, was launched. Open data is seen as a part of the initiative, although there are obvious synergies between e-Government and open data. An open data mindset or way of thinking should encourage better use of ICTs in government and, vice versa, a well-functioning e-Government project should increase the quality, quantity and timeliness of governmental data. The government open data portal includes a mechanism for citizens to propose and vote for ideas relating to re-use of open data: CIRDO (Catalogue d'idées de réutilisation des données ouvertes).

Other initiatives

Government transparency is tracked on a number of websites. PrésiMetre tracks and checks Government promises and claims around various projects. It has a "citizen dialogue" section which allows citizens to submit questions. Another website is the Centre for the Democratic Governance of Burkina Faso (CDG), a non-governmental organisation with the mission is to promote democratic governance, checking transparency by means of investigating government claims.

A "marchés publics" (public tenders) project scraped government contract data off PDF files to investigate the use of public funds and open up government contracts. However, the project appears to be stagnating due to lack of data and political collaboration.

The West-African citizen-based (i.e. crowdsourced) OpenStreetMap (OSM) has been quite active, especially for the capital city of Ouagadougou[149] . It is much more accurate and detailed than Google Maps. Public transport (bus) routes have been mapped as

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[145] https://schoolofdata.org/2016/11/05/the-state-of-open-data-in-burkina-faso/
[146] http://data.gov.bf as of August 2018.
[147] https://www.mmsp.gov.ma/uploads/file/Experience%20BurkinaFaso.ppsx
[148] https://theodi.org/project/case-study-burkina-fasos-open-elections/
[149] https://theodi.org/project/case-study-burkina-fasos-open-elections/
The francophone OSM initiative was launched in 2012 in Mali and Niger, in 2013 in Benin, Senegal, Togo and Côte d'Ivoire, in 2015 in Burkina Faso and Niger.

well as various (but not all) local businesses. It still lacks 'Kibera-like' interactive community mapping and slum mapping. The tourism potential remains an open question, but it already offers some promise if Ouagadougou wants to become a smart(er) city.

Open Burkina is a very active NGO focussing on using open data for government transparency, citizen participation and innovation. Its projects focus mainly on Ouagadougou including crowdsourcing data around power cuts, air quality and transport in Ouagadougou. It also aims to promote data journalism and monitor public accounts and Burkina Faso's national plans for social and economic development.

A Burkina Faso local project relating to the Extractives Industries Transparency Initiative (EITI) made a valiant attempt at bringing transparency to Burkina's gold mining operations, especially in the light of the alleged human rights abuse (child labour, worker exploitation, dangerous working environments), negative environmental impacts and financial irregularities. However, vested economic and political interests make cooperation and access to data impossible, so this project is currently on hold.

There are a number of other initiatives which claim to open environmental data about Burkina Faso, mostly from global organisations. Examples are Global Biodiversity Information (GBIF), Global Forest Watch and the IUCN's Red List Endangered Species. They obtain their data from crowdsourcing, satellite imagery and modelling. However, the quality, quantity, recency, representativeness and veracity of their data could not be assessed.

Conspicuously missing is data around agriculture, public health, electricity monitoring and transport. The situation regarding agricultural data is expected to improve substantially: now that a French-speaking director has been appointed at GODAN, the traditional 'neglect' (under-representation) of Francophone Africa will hopefully be a thing of the past.

Impact

The following table provides an assessment of selected OGD projects. Unless indicated otherwise, the impact discussion is based on interview data.

Table 7: Impacts of selected Burkina open data projects

Open Data Project	Impact assessment
BODI	Although BODI has positively influenced the mindset of ministry officials and bureaucrats, respondents were divided about whether open data was fully embedded in government, i.e. sufficiently institutionalised. Additional (international) funding was seen as a means to create more success stories so as to embed open data as "the new normal".
Open Election	This was definitely the flagship, being the most visible success and impactful of the Burkina Faso Open Data Initiative. All respondents agreed that it most definitely influenced the overall transparency and credibility of election results. *"It definitely made an impact, not just guesses. Everyone who was interested in the political process or results could now follow it, and pretty much all did. Perhaps not via the portal or website but via the media (room)."* Although the impact is a combination of communication infrastructure and independent electoral officials, having detailed, voting station level records available in real-time instead of aggregated ones distributed from a central centre qualifies this firmly as an open data project. Interestingly, it has not been decided yet if the same system will be used for 2020 elections. The National Independent Electoral Commission (CENI)'s team is almost entirely new, and the Government has not given them a clear mandate yet. On the other hand, many other countries have enquired about the process to learn from Burkina Faso's experience. CENI's director in charge of information and data systems (Mr N Tall), was explicitly asked to give a presentation at the recent regional, i.e. West African Election Network (WAEON).
NENDO and Carteau	NENDO provides information about local schools and Carteau gives the location of water points across Burkina Faso. Given that these are website based, they are not accessible by the majority of the population. Thus, they are still mainly used by government officials and international organisations. In fact, their most significant value may be as demonstrative proof-of-concepts for more advanced interventions. E.g. NENDO is currently focussed on urban schools; it needs to add many more rural schools. This will happen in the near future as both have been earmarked for data expansion. A mobile app would improve accessibility by citizens.

Open Data Project	Impact assessment
BeogNeere	This is not really a project, but a social entrepreneurship lab founded by two independent IT contractors. It also includes a psychologist, a sociologist and a statistician to form an interdisciplinary team. BeogNeere used detailed records to analyse gender inequalities. Another project used to show government expenditure, e.g. contract information (scraped from pdfs and investigated – although lots of data were missing, e.g. how many tenders, values, selection criteria etc.). Another impact is that it inspired them to think of how data can be used in innovative projects and to query what sort of data is still needed to answer societal questions/address low-level problems.
OpenBurkina	An NGO that promotes the use of open data in the interests of transparency and democracy. It has 6 current projects: promoting data journalism, following public works expenditure, following the progress of the National Plan for Economic and Social Development (PNDES); and three about the capital city Ouagadougou namely tracking power cuts; mapping public transport and measuring air quality.
Data journalism	Although there is a shortage of data-savvy journalists and supporting resources, some success stories have emerged. L'Economiste publishes data-based economic articles on a regular basis. Recent articles exposed corruption in the road (highway) construction tender/business (2017) and the gap between the political promise of 200 new primary schools being established when data showed only 97 were built (2018).
OSM Burkina Faso	OSM has not been used extensively. In fact, local taxi drivers appear to be wasting time and petrol in driving around rather than using OSM or Google Maps[150]. However, the OSM of Ouagadougou is much more accurate than Google Maps and most other street mapping information found on the Internet. If coupled with other databases, or if the map-layer is built into light-weight, useful mobile apps, it offers much potential.
Academia	A number of economic research institutes use economic and financial open data and statistics extensively. The University of Ouagadougou, the Centre d'études, de documentation et de recherche économique et sociales; Centre d'analyse des politiques économiques et sociales (CAPES); and Institut supérieur des sciences de la population (ISSP) have published research reports. Dr Borlii Some (Université Polytechnique de Bobo-Dioulasso) actually runs data analysis classes where his students use open data sets for their studies. Unfortunately, no findings or research gets published from this; it is merely used as an educational resource.

Challenges

Involving and engaging government bureaucrats in open data initiatives remains a challenge. open data projects need to budget significant amounts in order to provide attractive workshop venues, suitable standard catering and a per diem to get them to participate in workshops/events. This is not a phenomenon unique to Burkina Faso. Making open data part of their job description, providing a strong leadership push or instilling a more open data-friendly culture might increase the willingness of government officials to engage.

Apart from some noteworthy exceptions (see above), It is hard to involve the local academic sector because of their heavy teaching focus and lack of PhD programmes. This is despite the organisation of a series of conferences under the theme *"Open Data and Academia: Challenges and Opportunities"* as part of the BODI programme.

Citizens have access to smartphones and the internet (especially in the cities)[151], but they are focussed mainly on social networking. They need to be informed or taught about apps (including the internet). They do not access generic news articles since they are mainly interested in local implications, i.e. where it touches their lives directly. However, their use of social networks demonstrates their willingness and ability to crowdsource data, e.g. traffic issues, and other events are readily and rapidly dispersed through social media.

One of the main problems pointed out by one of the NGOs is that many open data initiatives are top-down, macro-driven and ignore real data needs and/

[150] Personal observation: many taxi drivers had Android phones and the data use of Google Maps is nominal when compared to that of the wasted petrol.

[151] In 2015, smartphone adoption in West Africa was estimated at 23% by the GSM Association, and projected to rise to 55% by 2020 (GSMA, 2016).

or issues on the ground. Top-level large initiatives formulate high-level data needs but ignore that the data must actually be collected and useful at the grassroots level. Thus, it is not evident that SDG/ Agenda 2063 or even PNDES indicators translate to actual improvement on the ground. Even at the national and local government levels, ministries are siloed, so they pursue their agendas independently of each other – including data gathering – which often means enormous overlaps but also large gaps. By contrast, on the ground everything is integrated/interrelated, e.g. gender discrimination, unemployment, hunger, health, and educational issues cannot be disentangled, but SDGs/macro or aggregated data by department separate everything out thereby losing the holistic picture.

Small players (NGOs, individuals, entrepreneurs) are struggling to obtain funds for small projects, e.g. in the US$10-15K range. There should be a mechanism for funding (shortlisting, selecting) a more significant number of relatively small grassroots initiatives without having to draft huge funding proposals for each and having to engage with the large bureaucratic processes and machinery of the international NGO 'dinosaurs'.

Datacamps and hackathons are successful in getting people from different backgrounds together. However, initiatives are rarely followed through: no future commitments are demanded, so prototypes never blossom into full-fledged apps or websites.

Language appears to pose big barriers for budding social and business entrepreneurs in francophone Africa: they have problems formulating and writing proposals; they find it difficult to participate in most international events (presentations, networking) but also the evidence (website; prototypes) and outputs (reports) need to be translated – not a small task for tech artifacts, e.g. websites. Francophone donor funds typically come from Canada and France. Note that the language 'barrier' was explicitly not identified as a barrier by government officials or those part of larger organisations.

Politics undoubtedly remains an issue. For instance, child labour in the mines was documented and, in particular, kids were found to be leaving school in order to go work in the mines. But despite the evidence, the local government failed to stop it (in fact, if anything, they appeared to support it because it created economic advantages to the mines)[152]. A simple solution, based on survey data gathered and shared by an NGO, was to provide school kitchens so kids would go to school (or be sent there by their mothers) because that is where they would get (free) food; previously the mines would attract the children by means of their cafeterias.

Recommendations

Open data is still not fully embedded in government structures so additional projects and more success stories would drive and establish open data as the new normal. The general recommendations made in this report will also apply to here: additional investments can be made in the supply side, but only if they are linked to (local) capacity building and impact measurement (i.e. useful datasets); but developing the entire eco-system including intermediaries and users is equally important.

The GIS data held by the Institut Géographique du Burkina (IGB) is of high quality, in digital format, and there is a willingness by the department to share this. But currently, legislation does not allow its unlicensed or free distribution to individuals (although it can be negotiated with organisations). Since GIS data is frequently touted as one of the most valuable and value-generating datasets when combined with other data, opening up this data should be a priority if wanting to achieve economic impact and stimulate innovation (Ezigbalike et al, 2016).

In the higher education sector, one small course (or module) could be created to train selected students specifically in the analysis of open data; these data analysis skills would be readily transferable to private sector employment. This course could be offered across all campuses of all universities. Additionally, an inter-university team should be created (and funded) to coordinate and promote open data-based research using competitions, funding and training.

To further promote data journalism, instead of just training journalists (who cannot afford to specialise in any case), they should rather be teamed up with a data analyst/team who can take care of the

[152] Personal interview. Similar issues were documented officially for neighbouring Mali: https://www.hrw.org/report/2011/12/06/poisonous-mix/child-labor-mercury-and-artisanal-gold-mining-mali

technical analysis/details so that the journalists can concentrate on investigating the question. Ideally, an expert could be seconded for a period of say 3 or so months (given that an internship of a journalist in a statistics department is impractical); this could be an international expert, but it would preferably be local, e.g. postgraduate data analysis students could be used. This could link with the suggested open data course suggested in the previous paragraph.

Hackathons and data camps organised as part of larger funded open data initiatives need to follow up on commitments and resultant initiatives.

Given the reluctance of the BODI/Statistics Office to publish anything but the highest quality datasets, perhaps a special (closed?) platform, forum or channel for lower quality datasets could be created. A related suggestion was that the INSD should make more serious efforts to "vulgarize" (sic), i.e. simplify/popularise/deconstruct their data so that it is more accessible to non-statisticians or non-specialists. This would include visualisations and textual descriptions. Although the INSD does hold events where data is officially released, many can't attend. Perhaps a social networking professional, visualisation expert or dedicated journalist can be tasked with this.

A permanent network of all open data stakeholders (i.e. statisticians. government officials, journalists, entrepreneurs, data analysts, academics) should be established and resourced, not just an ad-hoc forum. The question of how to incentivize the commitment of all parties/stakeholders remains open, but that could be their first meeting agenda. This network would be supported by a suitable (technical communication) platform and also allow for temporary, more intimate collaborations (interdisciplinary mini-teams) between the intermediaries themselves, such as teaming up a journalist or NGO with a data-analyst (student or professional or external expert) for a specific project.

Country Case: Morocco's long, slow journey towards open data

Despite an early start, Morocco has made slow progress on open data. On the one hand, it launched the very first African open data platform in 2011. However, after an initial flurry, activities all but stalled around 2104; and the quantity and the quality of the datasets have not shown much change or improvement since then. There appeared to be very little commitment on the part of the government to publish up-to-date or additional data sets, and there is very little evidence of use or impact of the open data which was published.

However, as of 2018, there are now hopeful signs that the open data policy is getting much higher visibility on the government radar again. It is becoming a higher priority due to the adoption a new law on the right of access to information and due to a new national engagement on OGP related to data publication and reuse. This will hopefully revitalize and increase the open data commitment of government and its impact on society.

Given the low government commitment to, and impact of open data to date, this section will have only a brief section on some historical open data achievements, and thus focus more on the open data context and the way forward for open data.

Historical timeline and selected events

After the establishment of Morocco's open data portal, there was an initial flurry of activity and excitement. This is embodied in the elaborate and substantive report issued by Morocco's Economic, Social and Environmental Council (Conseil Economique, Social et Environnemental, 2013). In particular, it identified two phases for the full implementation of what was described as "an ambitious policy' to open up public data in Morocco: the first phase was to put in place a movement to 'liberate' the open data (supply side), the second phase to develop an ecosystem to use these data (pp53-56). Sadly, this ambition was not realized, given that no new open datasets were released after the following year (2014).

Some significant open data milestones or activities are listed below.

- Morocco launches first OGD platform in 2011.
- Morocco joins Open Knowledge network in May 2013.
- Morocco relaunches OGD platform using the open source CKAN software end Nov 2013.
- A national colloquium on 'Open Gov and Open Data' is organised on 6 May 2014 as part of the JMaghrebConference.
- An open data hackathon is held in Casablanca on 4 and 5 Nov 2014.
- The Open Data Barometer lists Morocco as 2nd in Africa; 40th worldwide in Oct 2013.
- The Global Open Data Index ranking for 2014 places Morocco as #79 (on the global rankings) with a slight improvement in the 2015 ranking (#76).

However, few public activities were held since then and no new datasets published after 2014 on the central open data portal. Thus, the period under review for this report (2015-2018) can effectively be referred to as somewhat of an open data 'winter' for Morocco.

Context

Legal framework

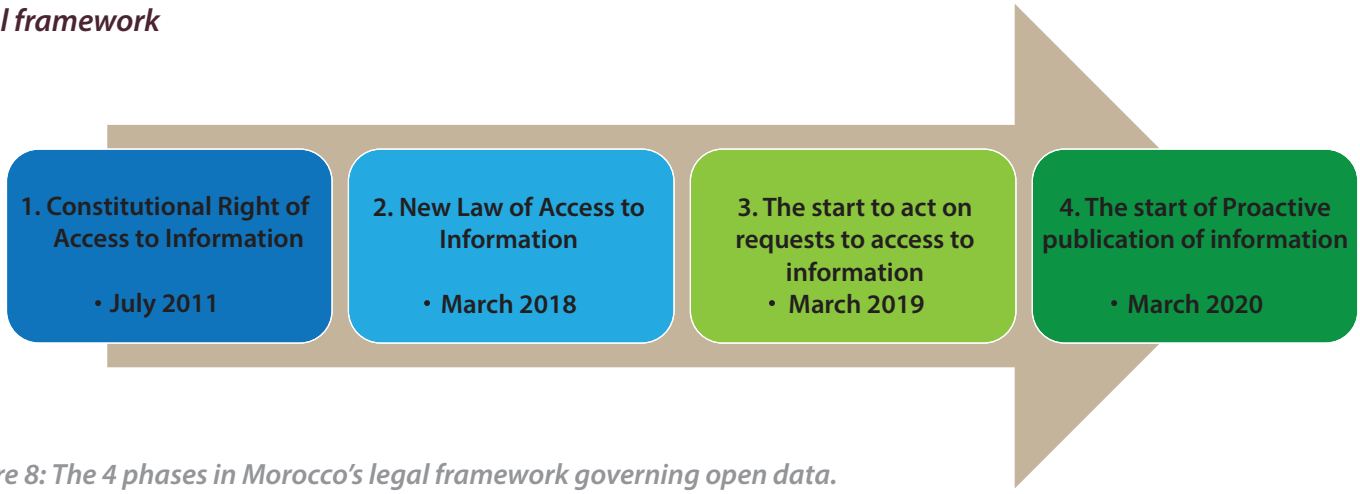

Figure 8: The 4 phases in Morocco's legal framework governing open data.

The evolution of the legal framework related to open data can be described using the following four phases (Figure 8).

Access to Information became a fundamental constitutional right in 2011[153]. The new 2011 Constitution explicitly set forward the right to access to information in its article 27: *"Citizens have the right of access to information held by the public administration, the elected institutions and the organs invested with missions of public service. The right to information may only be limited by the law, with the objective of assuring the protection of all which concerns national defence, the internal and external security of the State, and the private life of persons, of preventing infringement to the fundamental freedoms and rights enounced in this Constitution and of protecting the sources and the domains determined with specificity by the law."*[154]

In March 2018, seven years after the adoption of the Constitution, the law of the Right to Access to Information (RAI) was finally promulgated, after many years of drafts and revision. It gives citizens the right to submit requests for information and dedicates a whole chapter to proactive publication of data. Public administration is encouraged to publish proactively data that would be useful for the public.

The implementation and the treatment of requests of Access to Information will, according to the RAI, only start in March 2019. From that date, users would be able to submit requests, expects official responses and appeal if they are not satisfied with the response, as stated by the text of the new law.

Finally, as per RAI, the implementation of the proactive publication of information would start in March 2020. Different concerned public organisations are expected to publish data. The Access to information law has shared examples of data to be published :[155]

- *"Conventions where the adoption or ratification procedures are in progress.*
- *Legislative and regulatory texts.*
- *Draft laws.*
- *Draft financial laws and annexed documents.*
- *Law proposals by members of the parliament.*
- *Budget data of local governments.*
- *Mission, structure and contact information of different Government entities.*
- *Procedures, bylaws and guides used by public servants for professional usage.*
- *List of services provided by administrations to users, including list of documents, data and information requested to obtain a service.*
- *Rights and obligations of users related to their relationship with the administration, as well as possible appeal procedures.*
- *Conditions to obtain authorizations, licenses and exploitation permits.*
- *Detailed results of different elections.*
- *Provisional programs of public tenders, their results, their beneficiaries, and the corresponding amounts.*

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[153] Interestingly, the Constitution was informed by crowdsourcing citizen inputs. As a result of mass demonstrations calling for political reform, the author of this report section launched the *Reforme.ma* platform. This gathered more than 200,000 visitors who left over 10,000 comments and suggestions for the Constitution. Apparently, 40% of the suggestions were included, in some form, into the new Constitution. The tool was subsequently ported to a global platform (Legislation Lab at http://legislation.org) and has been used successfully at least 14 other countries. Source: http://thegovlab.org/how-morocco-formed-a-citizen-powered-constitution-and-now-everyone-can-too/

[154] https://www.constituteproject.org/constitution/Morocco_2011.pdf

[155] Article 10 of Law 31-13 related to the Right to Access to Information

- *Programs of recruitment tests and professional exams, and the corresponding announcements of their results.*
- *Announcements of call for candidates of high responsibility jobs as well as the list of candidates admitted to take exams and the corresponding results.*
- *Reports, programs and studies by the administrations.*
- *Economic and social statistics.*
- *Information related to companies, particularly data owned by the National Registry of Commerce.*
- *Information to guarantee free, fair and legal competition."*

Open government datasets

While the legal framework is important to guarantee the adoption of open data by the public administration, selected ministries already took the initiative and built pioneering data platforms (Khtira, 2017). Some major initiatives are presented below: the central data portal, legislative data and financial data.

The central data portal

As part of its e-government strategy, the Ministry of Industry, Commerce and New Technologies launched its first open data platform in March 2011, which positioned Morocco as a pioneer country in Africa with respect to open data. The data portal grouped data in a single access point to users, and published data in open usable format. As of November 2018, it included about 136 datasets. Of these 52 (38%) datasets were financial data produced by the Ministry of Economy and Finance. Only 15 public administrations had shared data through this platform. The last data addition to the platform was made in 2014.

In general, the open data posted on the platform suffered from the following problems:

- Paucity of data: The portal published a limited number of datasets (136), which made it hardly interesting for individual users and the private sectors.
- Inclusiveness: Only a limited number (15) of public institutions had published data. This raised the question about the political will to support open data and the need to adopt an inclusive strategy.
- Relevance: Given that the data was out of date, it may lead to incorrect or irrelevant conclusions. There was no explicit strategy for data update and verification.
- Correctness: Looking at the previous problems, the question of correctness remained open since there was no clear indication if this data was official, verified or licensed free for reuse.

Legislative data

The General Secretariat of Government has digitized and published all official bulletins ('gazettes') since 1913. It also provides a dedicated search engine for the laws published in the gazette. The portal also offers channels for citizen participation to share comments and proposals on draft laws.

Financial data

The Ministry of Finance publishes various data related to the budget in various electronic formats, including PDF, MS-Excel, MS-Word, and html. It has also published an accessible simplified guide to the budget, called "Citizen Budget", to make financial data comprehensible to non-expert readers. Between 2008 and 2018, the Open Budget Index evaluation of Moroccan financial transparency has moved from weak (19 points) to limited information (45 points), putting it exactly halfway on the list of countries surveyed (58th out of 115) [156].

Other government data

There are additional governmental data portals.

- Real-time meteorological data is available from a dedicated meteorological portal: http://www.marocmeteo.ma/ although no historical time series data were found.
- The High commission for Planning (Haut-Commissariat au Plan) releases some data related to the national plans on its portal (https://www.hcp.ma/).
- The Exchange Office put the foreign trade database online (http://www.oc.gov.ma/DataBase/CommerceExterieur/).
- The Department of Studies and Financial Forecasts opened up MANAR-STAT, a statistical databank (http://manar.finances.gov.ma/manar/initAccueilInscription).

Sadly, there is a huge amount of useful data which remains 'locked up' inside government departments.

[156] https://www.internationalbudget.org/open-budget-survey/open-budget-index-rankings/ using the 2018 rankings.

The departments of agriculture and fisheries have conducted valuable research on soil quality and fish stocks respectively, but this data is kept locked up and only available to a few privileged stakeholders. Detailed health or educational data is hard, if not impossible, to obtain from official government departments. Whether this must be attributed to a culture of secrecy, a sense of privileged data ownership ('information is power'), or lack of guidance and regulations, is a matter for discussion with the findings likely to vary between departments.

Open Government Partnership

The Moroccan Government joined the Open Government Partnership in April 2018, and launched its first action plan in August 2018[157]. One particular OGP commitment focuses directly on open data: Commitment 4: *"Increasing the publication and reuse of open data"*.

"This commitment consists of the following action items:

- *Creating a national data strategy*
- *Creating governance for open data to coordinate the policy of openness and the sharing and reuse of public data by all stakeholders, including the private sector and civil society.*
- *Embedding a structure within the ministerial departments, public institutions, and territorial authorities that enables the selection, collection, categorisation, and validation of data to be provided to the public or published according to the laws in force.*
- *Developing a manual setting the rules for collecting, processing, disseminating, and updating open data.*
- *Training data officers within government departments and public institutions on rules for collecting, processing, disseminating, and updating open data.*
- *Communicating and raising public awareness (government departments, citizens, companies, researchers, tourists, investors, civil society, etc.) about the benefits of openness, sharing, and reuse of data.*
- *The impact of this commitment will be assessed on the basis of the following indicators:*
- *Number of institutions participating in the Open Data Strategy (to be increased by 100%: from 16 to 32 institutions)*
- *Number of data sets published on the platform data.gov.ma (to be increased by 100%: from 136 to 300 data sets)*
- *Number of data reuse initiatives: 20 initiatives*" (Morocco, 2018, pp.13-14)

Table 8: Milestone activities in the OGP open data commitment (source: Morocco, 2018, p14).

Milestone Activity with a verifiable deliverable	Start date	End date
Benchmarking data strategies	October 2018	December 2018
Assessing the status of data in Morocco	December 2018	April 2019
Developing the strategy rules of procedures of public data	May 2019	October 2019
Creating a governance devoted to open data	November 2019	January 2020
Preparing the procedures manual for collecting, processing, disseminating, and updating open data	November 2019	January 2020
Training government departments on proactively publishing open data	February 2020	March 2020
Communicating and raising awareness about the benefits of open data	January 2020	June 2020

Closely related is commitment 5: to establish a mechanism for the sharing of environmental data by means of a national observatory for environmental and sustainable development. This aligns directly with SDGs 13, 14 and 15.

Use of open data

While Moroccan civil society has been playing a very important role in the recent history of Morocco as an actor of advocacy, assistance and protection, very few organizations have taken the leadership to study and reuse the available public data and advocate for more publications.

Yet, interest and demand for more government information and data are prevalent among the citizens. A 'nano' survey held on behalf of the World Bank in 2014 among Moroccan internet users investigated, inter alia, the appetite and demand

[157] Available in both English and French from https://www.opengovpartnership.org/documents/morocco-action-plan-2018-2020
[158] https://riwi.com/rdit-measures-citizen-thoughts-in-morocco-for-the-world-banks-project-on-open-data/

for information. From the 15,020 partial and 3,942 complete responses, some very interesting statistics emerged [158]:

- 71% of respondents stated that they found public information hard to find or access.
- The same proportion, i.e. 71% of respondents wanted access to public sector information with 63% being aware of their constitutional right to information (although the Access to Information law had not been enacted yet at that time).
- 26% of respondents were willing to pay for information. The internet was the preferred means for access.

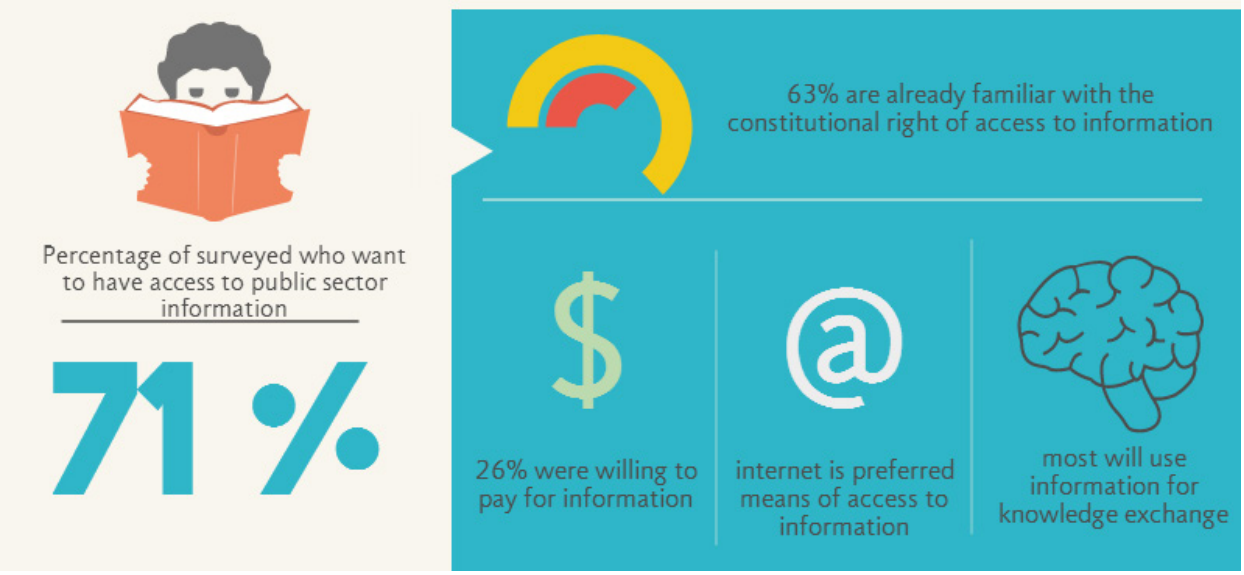

Figure 9: Some key findings from the World Bank's 2014 survey (source: RIWI)

There is a relative paucity on publicly documented use cases of open data in Morocco. The research uncovered some interesting and promising applications (some of these arose in the interviews).

Table 9: Sample uses and applications of open data in Morocco.

Sector/Impact Type	Example uses/applications
Academia	Some Moroccan academics used open data as the basis of their research. However, in both cases, it appears that the data used was actually sourced *outside* Morocco (Ezzine *et al*, 2014; Salhi *et al*, 2017). Interestingly, neither of these two papers is accessible as open access.
Citizen-created open data	The Open Street Map project (citizen-generated open data) appears to have been very active and is ongoing; e.g. the renaming of roads in 2018. TAFRA, an NGO aimed at transparency in and ensuring democracy in elections, has painstakingly manually captured, integrated and verified two decades of election data, as well as some other datasets, and will release these online as 18 open data sets in December 2018. To illustrate the value of the datasets, illustrative sample analysis projects and charts will be included e.g. correlating voting behaviour with education level / poverty indicators.
Open data hackathons	Diplohack Maroc was held in 2015 to celebrate International Women's Day and used open data to explore women's issues. On 19 May 2017 there was the Open4Citizens (O4C) in Casablanca with three of the six proposed projects awarded prizes. Sadly, nothing appears to have come from the winning projects (CasaLibrary; WeGreenMove; CasaWeClean)[159]. Open Data Day 2017 was held in Rabat, with the aim of building awareness of open data among citizens and journalists (also: Marocviz was launched.)
Online (web) platforms	A civic tech organization built Marocviz, which is a platform offering visualizations for some of Morocco's public data. Marocviz aims to "make information accessible and digestible with narrative visualizations. The platform was shortlisted out for funding from the innovateAFRICA fund."[160]

[159] The lack of turning hackathon ideas and PoCs into real innovations or apps appears to be somewhat of a sad red line (admittedly not just in Morocco).

[160] https://www.opengovpartnership.org/stories/morocco-opendata-visualization-engine

Mobile innovations	ICT4Dev built Floussna.ma, a gamified web application with the purpose of informing and educating the public about the new budget law (using open budget information). Nouabook.ma is an online platform, developed by Simsim association, to promote the interaction between citizens and their parliamentary representatives. Ribatis launched DATAURBA mobile app on 31 Oct 2018, which lists various performance indicators for selected communities and suburbs within Casablanca.
Training of open data specialists	In 2016, Mundiapolis organized a data journalism bootcamp for about 40 people over the course of 3 days. They also created a dedicated Masters course in open data. About 15 students enrolled and these were given internships in national government with the aim of showcasing to government officials how (open) data could be useful. TAFRA organized a summer 2018 camp with about 30 university students to train on the data analysis (of their to-be-released open data sets). Sadly no concrete outcomes have materialized yet from the student projects.

Challenges for open data

The research discusses a number of key challenges to the further institutionalization and impact of open data are highlighted, including legal, organizational and cultural.

Legal gap

The current legal framework sets a strict protocol for access to information and promotes the proactive publication of information. However, the lack of a binding legal framework of open data makes its application by the different administrations, at best, optional. A public servant tends to only execute required tasks and avoids any action that is not mandated and may be the source of blame. As a result, the current regulations by themselves will be insufficient to ignite the open data revolution in Morocco.

Sometimes the laws actually exist but are not enforced. For instance, 'la loi organique (113-14) des communes territoriales' mandates the publication of budget, procurement, meeting summaries, projects etc. but this is not or rarely done in practice. Similarly, tenders are made public but crucially important information is often missing, like whom the winning tender was awarded to.

Organizational gap

The current organigram of public administrations does not have an explicit role of a data officer, or at least somebody who would be responsible of data publication. The lack of explicit responsibility assignment for data publication will likely hinder any action to make systemic promotion of open data.

Weak demand for open data

The current public debate focuses mostly on the right to access to information, and less on open data and data publication. The weak data demand is not sufficient to successfully advocate and push for more data openness. This is a vicious circle: the lack of good, usable open data means that there are no good show cases of open data use, and the lack of examples of open data use is used as justification for government's lack of commitment.

Recommendations

Give the above context and gaps, as well as the experience on the ground, a number of recommendations are put forward to enhance the creation and potential use of open data.

Provide clear, unambiguous leadership from the top in support of open data

Moroccan government bureaucracy is fairly hierarchical with a traditionally 'closed' culture prevailing. A clear and strong leadership position committing to and encouraging open data across all tiers and sharing of data between departments is vital. This will enable the civic-minded and service-delivery oriented government officials that are willing and keen to share and open data to overcome the inertia and resistance offered by some of their colleagues. This leadership should also ensure that existing laws which instruct government departments to publish information are respected.

Use the Access to Information Act as a lever

To overcome resistance and effect positive change, enact and use the provision of the Right to Access to Information Act to force reticent departments or officials to open up their data. In particular, the provisions around 'pro-active' release of data are potentially a great tool to achieve this. The current law includes a wide range of exceptions; it is important that these exceptions be interpreted in their narrowest possible meaning. In addition, it is vital that the Government raises widespread awareness about the Access to Information Act. In the past, Morocco has promulgated a number of positive laws (e.g. around corruption fighting), but

the lack of awareness left these laws under-utilized. Currently, the OGP actions which the Government committed to are invisible in the local press or on the Government website; these need to be given greater visibility and clear support by the Government, instead of relying on NGOs to spread the word.

Put pro-active enabling regulations in place

In order to institutionalize open data, explicit regulations related to the following fields need to be put in place.

- **Data proactive publication:** This regulation addresses questions like: what data should be published? Who, within the public administration, should be responsible of publishing it? Where should the data be published? What penalties are put in place if the regulation is not respected?
- **Data interoperability:** To build a successful foundation for open data, it is important to offer data in open format, and to enable consuming data using web services. It is also crucial to build interoperation between different administrations to enable offering richer data from cross administrations.
- **Data reuse:** It is often not clear for data consumers if data is free for reuse and/or for commercial use. It is important to set expectations on both parties. The best way to do this is by means of explicit open licensing or stating explicitly on the data portals/in legislation that published data can be re-used.

Give civic society a real voice in determining which data to open

The current plan is that the top-level governance structure for the open data OGP action will consist almost half of representatives from civil society to ensure input about the relevant and useful data sets to be used. At the lowest level (3rd tier) public forums are envisaged for the eight thematic areas of the OGP action plan (including corruption). If these representatives are given a strong voice and their requests, where reasonable, are acceded to, successful data reuse will be assured, and a leading example will be set for other African countries to follow.

Appoint and train of data officers in each department/administration

The human factor is key to the success of open data. Capacity building is fundamental piece of the change management process. It is important for different administrations to appoint dedicated data officers who will be responsible and accountable for collecting, analysing, formatting and publishing data. It is also important to provide adequate training as well as equip the data officers with the skills and the capacities to operate successfully. Apparently, sufficient financial resources have been allocated to ICT projects in government; however, a sufficient proportion of these needs to be set aside for the open data initiative.

Promote data demand through awareness building and capacity development

The success of open data relies on building an ecosystem of supply and demand. There is an urgent need to raise the awareness of and demand for open data. In Morocco, there would be two systemic types of demands for open data: governance- and economy-related ones.

- Better governance: Few civil society organizations have taken the leadership on pushing the demand for public data, yet a stronger and more coordinated civic tech movement would have a more considerable weight to demand data. Disaggregated data relating to government expenditure (including procurements and projects) but also health, education as well as crime and justice data are vital in this respect.
- Data businesses/innovation: Data, the new oil of the 21st century, can fuel the economy with new types of businesses. The number of data-based businesses is increasing sharply. The Government should enable data businesses and data-driven innovation by encouraging and providing useful datasets, for instance data related to transport, geographic (cartographic data is currently strictly copyrighted), low-earth-orbit satellite imagery, agriculture and fishing, land registries, registered corporate and non-profit entities, and longitudinal meteorological data.

Additionally, capacity must be built in civic society to enable them to use and analyse data. Data scientists are not only vital to NGOs and in media/journalism who want to use data, but they will be equally essential for the future of Morocco's private and public economic sector.

9 SUMMARY OF FINDINGS

"In many instances, the benefits of open data are celebrated despite little concrete evidence to prove that opening data has in fact created positive on-the-ground impacts at a meaningful scale. In addition, when evidence is being presented, little distinction is made between intent, implications, and impact." (Verhulst, 2017, p.2)

The overall finding is a mixed picture but with many positive signs

The findings relating to the current status of open data are mixed. In many cases, there is evidence that the national government's commitment to open data has stalled, questioning the degree to which it was or is institutionalised in many African administrations. However, this is not just applicable to Africa: there appears to be a "back-pedalling" of open data initiatives globally, at least in some quarters[161]. Already in 2016, the 4th Edition of the Open Data Barometer found that *"Governments in the UK, US, and Nordic countries had all taken steps backward [in 2016]"* and *"Government data [in those and other developed countries] is usually incomplete, out of date, of low quality, and fragmented"*. This view, echoed by Verhulst (2017), is arguably overly pessimistic and unbalanced. The author would argue that it is more likely that, to put it in Gartner's hype cycle terminology, the 'peak of inflated expectations' has been passed, and many governments are now going through a temporary 'trough of disillusionment' before climbing the 'slope of enlightenment again' in order to reach the promised 'plateau of productivity' (Figure 10).

[161] *"In 2017, Tanzania suspended its activities within the Open Government Partnership (OGP), calling the partnership a foreign intervention. [. . .] After hosting the continent's first ever Open Data Conference (Africa Open Data Conference) in 2015, [this] suggests that 'openness' may be becoming less attractive and that some places where progress on openness had been made may be backsliding."* (Brandusescu & Nwakanma, 2018, p.9)

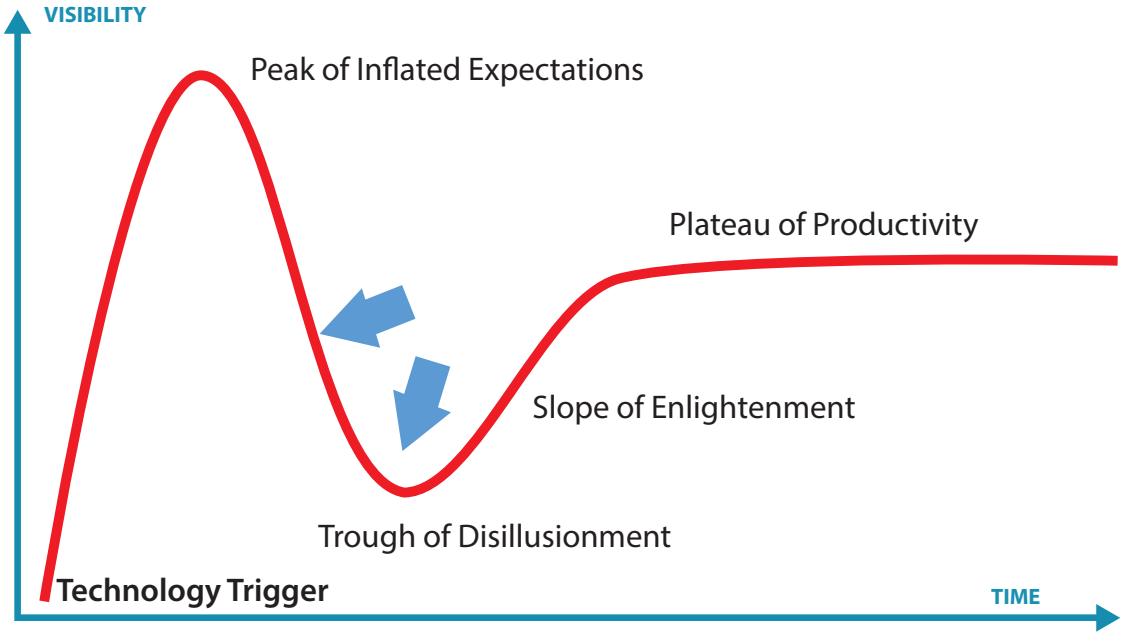

Figure 10: Potential position of the open data phenomenon using a hype cycle lens (Figure source: J. Kemp, Wikipedia)

Alternatively, in some governments, there is a slowly iterative cycle between innovation, adoption, resistance and re-alignment before finally resulting in institutionalisation and eventual maturity. Each country presents a very complex picture which has often been the focus of dedicated academic research using institutional, actor-network, structuration or other theoretical lenses[162] .

The Africa Open Data Index 2018 looked at 15 core datasets and found that, for most datasets, a majority of countries provide at least some core data online. However, only one-third of data is provided timeously, reducing the value of most (outdated) datasets. Very few (6%) of the published datasets have explicit open licenses. The Open Data Barometer 2018 Africa edition shows rather slow progress in open data across much of the 30 countries surveyed. However, this picture is representative of world-wide trends and should be contextualized in both the diversity of the continent and the low resource base in many African countries. Encouragingly, 80% of countries maintain an open data reference catalogue. Open data readiness in government appears to be fairly low and not institutionalized. One or a few strong continental or regional champions and leaders are needed, to demonstrate the benefits and impacts of an enduring, committed, well-resourced open data initiative. However, many initiatives and impacts remain undiscovered or under-reported; hopefully this report makes some minor amends to this situation. The impact focus of many programs appears to be on transparency and less on economic benefits, innovation or social service delivery.

Political leadership is often lacking

Open data needs to be committed to by the political leadership, entrusted to a dedicated and adequately resourced custodian but then embedded through permanent data processes and a pervasive culture within all relevant MDAs. This takes ongoing leadership and commitment inspired by a true belief in the benefits of open data to the society. It cannot be achieved by short-term stand-alone, once-off externally funded initiatives focussed on purely quantitative objectives such as making a given number of datasets available.

[162] Indeed, the institutionalisation of OGD in Kenya, Ghana and South Africa each form the specific object of doctoral research projects by three of the contributing authors.

Successful OGD projects require committed, long-term partnerships

The stalling and abandonment of OGD projects in some countries does not take away the real impact of donor-funded and other partnership-supported initiatives. In several African countries, there appears to be a genuine political will to open up government datasets, not only for increased transparency but also in order to achieve economic impacts, social equity and to stimulate innovation. Often this is among the poorer countries who lack financial, human and technical resources to open up data. For them, allocating budget to OGD where urgent and most basic public health, food and education needs need to be prioritised is politically not feasible. This is clearly a case for supra- and international agencies to continue to support and invest in OGD initiatives: good and open data is a key requisite in ensuring that ongoing budgetary allocations to humanitarian policies (health, food, clean water, education, gender equality) are spent equitably, productively, where the need is greatest and without corruption.

Nevertheless, externally funded OGD projects need to focus more on local capacity building within governments, insist on institutionalising measures, ensure that the datasets released are the ones that address needs rather than being ones that are easy to open up, and involve stakeholder consultations. If this does not become the key focus, all that will happen is the ongoing creation of white elephants: abandoned data portals with unused old datasets.

Open Government Data in Africa exhibits impact pathways and patterns different to those in the Global North

This report has not found evidence to substantiate economic or quantifiable monetary benefits anywhere near the magnitudes claimed by some northern consulting groups, i.e. claiming potential impacts from 0.4% to 4.1% of GNP. However, in a number of cases, crucial and decisive benefits accrued from sometimes small open data interventions.

In particular, opening up election data has had an immeasurable impact on the transparency and acceptance of selected key elections: in three of the six country cases – Burkina Faso, Ghana, and Kenya – credible, verified election data at the level of individual voting stations was made available immediately, resulting in publicly transparent elections. When this open election data is supported with an independent observer system, a real-time and trustworthy communications infrastructure and a vibrant news media community, it has led to peaceful democratic elections in sensitive and fragile political environments with outcomes relatively uncontested. These achievements must be contrasted to elections, often in the very same countries (Kenya) or regions (West Africa) where other, non-open elections have resulted in ongoing violence and rejection of the democratic process or outcomes. Given the humanitarian cost of violent elections, and the incalculable benefits of a stable society and political environment necessary for any SDG progress, it can be argued that the positive and demonstrated benefit of just these few open election events alone more than justifies any and all historical investments made in OGD in Africa.

Another fascinating case was how open data could be used effectively by the government to influence and change citizen behaviour[163]. During the recent water supply crisis in Cape Town, the local government first opened up data around water supply by making detailed daily readings of dam levels and count-down estimates towards 'day zero' when taps would run dry (also making the prediction model as transparent as possible). However, the City of Cape Town also took the unprecedented step of releasing micro-data about individual consumption patterns to the extent that monthly updated water consumption patterns *at the individual homeowner/plot level* was released and rendered graphically on a zoomable, high-resolution map interface. This approach, sailing quite close to

[163] Interestingly, this is not a type of impact effect evident in any of the theoretical Open Data impact models.

possible privacy concerns, combined social pressure to reduce the consumption patterns of over-users, thereby encouraging a competitive – sometimes communal – spirit of trying to reduce consumption even further. Furthermore, it also served to dispel 'fake news' e.g. allegations were made that the free-running, unlimited taps in impoverished townships were a significant cause of water use. In reality, 'free tap' township consumption represented less than 3% of total household water consumption, despite townships constituting a sizable portion of the Cape Town population. Again, like with open election data, the specific contribution of opening up data cannot be disentangled from other initiatives, including the perhaps exaggerated scare tactics approach, drastic financial tariffs, physical interventions (drop in pipe pressure, installation of cut-off valves), etc. But the fact remains that opening up data contributed towards a world-celebrated previously unheard-of change in water consumption behaviour in an urban crisis situation which is sadly likely to occur in many other cities.

Focus needs to be on the entire open data ecosystem, including intermediaries

A crucial finding is that open data in Africa needs a vibrant, dynamic, open and multi-tier data ecosystem if the datasets are expected to make a real impact. Citizens are rarely likely to access open data themselves. But the democratizing of information technologies and communication platforms has opened up opportunities among a large and diverse set of intermediaries to explore and combine relevant data sources, sometimes with private or leaked data. The news media, NGOs and advocacy groups, and to a much lesser extent academics and social or profit-driven entrepreneurs, have shown that OGD can create real development impact.

The role of open data intermediaries is crucial and has been insufficiently recognised in the African context. In more mature democracies with deep resources, transparent communication infrastructure and a highly educated population, and, often, a long history and entrenched culture of citizen engagement if not activism, a deep ecosystem of data stakeholders can be taken for granted. For open data to make a bigger impact in Africa, the ecosystem needs to be strengthened more. Although activism, social entrepreneurship and community spirit are thriving, data analysis skills and resource pools are shallow and dispersed; institutional structures and support are often fragile, and democratic processes or legal protections may be insufficiently entrenched. Support initiatives focus on the top-down and supply-driven approach. In practice, much of the impact is created at the grass-roots level, by a diverse set of small players. Complicating this even further, as put so succinctly by one interviewee: *whereas at policy or macro level, it is easy to focus on one particular goal such as poverty, on the ground, all problems are intermixed*. An NGO trying to effect positive change in a rural community has to deal with food, water, economic survival, health, education, gender and corruption issues holistically; it does not have the option (luxury) of isolating any single issue if it wants to make a sustainable intervention. This means that a different type of intervention or support mechanism is required to improve the impact of open data initiatives: support needs to be more agile, less formalised, easier to access, small-grained, allowing for more failures (i.e. higher risk tolerance) and focussed on multi-pronged and more holistic outcomes.

> *"Supporting open data intermediaries can provide important returns both in social terms as in terms of the efficiency of the program. […] End users (micro level) were quite difficult to reach. Our research also showed the success of engaging and building the capacity of collectives that bridge the needs of the underserved with the actors that can address them (macro level). Setting as a priority the support for open data intermediaries (meso level) can bring much more capillarity to program outcomes (in effect widely extending the overall network) and would move the program further in the direction of the demand-side, as was raised earlier. The meso level – data journalists, open data advocates, hacktivists, open data local organizations and grassroots networks, technology organizations, grassroots organizations – provide a much-needed bridge between the macro level – policy-makers, decision-makers, regulatory bodies, global "for development" networks, national statistics offices – and the micro level, where needs are accurately diagnosed, and solutions are to be applied. They also provide a tight tissue of formal and informal networks with high levels of trust, enabling the quick spread of instruments and knowledge, or of shared diagnosis that can benefit from higher level (up to global) approaches." (Acevedo-Ruiz & Peña-López, 2017, p.14)*

The continent's unsung heroes are the data journalists

One set of stakeholders that has perhaps created a disproportionately large share of the impact is the fourth estate, i.e. the very small contingent of data-driven journalists. Not only did they play a crucial role in the open elections, but they continue to play a key role in promoting government transparency, advocacy of marginalised communities and building stronger democratic structures. This is taking place in an environment where there are often strong political pressures, lack of resources to the media sector as a whole due to declining revenue streams, and against a public tendency of wanting to see more polemic or dramatic news stories i.e. the public preference for stories about sensational crimes, natural disasters, celebrities and sports rather than exposure of corruption or disadvantaged communities. A few talented, dedicated and idealistic journalists (and their supporting editors and media houses) have to be applauded – and more concretely supported[164].

"Many journalists face financial challenges and are struggling to survive, even within their own media outlets, where there is no will whatsoever to publish these kind of stories or to fund them. These are journalists who regularly put their leaders on the edge. Some of the [participants in the CENOZO workshop] are the only actors that hold their governments accountable in their country." Samuel De Jaegere [165]

Africa's academic community needs to step forward

One sector that has so far perhaps 'underperformed' in terms of potential open data impact is the academic community. Sadly, the academic sector in most of Africa is under-resourced with funding to higher education institutions constantly under threat, emphasis on teaching rather than research, ongoing academic brain drain and lack of dedicated research funding. Nevertheless, post-graduate research students and academics should take an intellectual leadership role in open data. Not only by doing research around local open data initiatives, but chiefly so by making more and better use of various open data sets to produce socially relevant and visible research. In addition, the African research community must also start acting as a provider of open data by opening up its research data sets, given that good primary research data in Africa is already in short supply – although initially most use of open research data could realistically only be expected within its own ranks. The role of open data is not only vital for research purposes, but also in training a capable cadre of data analysts for professional careers in government and the private sector. Initiatives, where open data sets are used in data analytics courses, will provide the necessary key skills to enable African economies to partake in the fourth industrial revolution.

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[164] For instance, it is almost without doubt that the razor-thin win in South Africa at the end of 2017 of Ramaphosa's election to the ANC and subsequent national presidency over the pro-Zuma faction was almost entirely due to the ongoing and relentless exposure of state capture and corruption by the public media. The efforts of a few journalists and other courageous individuals have undoubtedly halted South Africa almost guaranteed slide into another 10 years of wholesale corruption which would have led to an almost certain destruction of the economy if not the entire democratic fibre of its society. It remains to be seen how Ramaphosa's government will unfold, but the hopeful signs are currently there that the painful rebuilding of the moral fabric of government (and complicit private) institutions has started. The narrative is ever-changing but https://en.wikipedia.org/wiki/South_African_general_election,_2019 gives an ongoing almost real-time commentary. This probably under-estimated close shave for South Africa's future trajectory must be attributed to a combination of not strictly open but public and leaked data about corruption.

[165] As quoted in https://gijn.org/2017/05/15/west-african-journalists-launch-investigative-hub/

SUGGESTIONS AND RECOMMENDATIONS[166]

10

Of the five recommendations from the global Open Data Barometer 2016, this report emphasizes and reiterates the following three as being vital to Africa's Open Government Partnership projects: governments must integrate open data across all agencies and departments; governments must consult citizens and intermediaries when prioritising which open data to publish first; and governments must invest in using open data to improve the lives of marginalised groups. However, this report also makes some additional recommendations, aimed at various decision makers and policy setters in the open data ecosystem.

Keep pushing for the importance and advancement of OGD

"In the fight against poverty in Africa, (good) data will make a difference. Better data will make for better decisions and better lives" Makhtar Diop, Vice President, Africa Region, World Bank (Beegle, 2016, p. xii).

Despite pushbacks from politicians, reductions or removals of funding, constrained resources, and multiple conflicting policy priorities, the underlying importance and potential impact of open data remain as valid as ever. Although some of the impacts have been oversold by certain open data evangelists, it remains an incontestable fact that the impact is almost always many times greater than the marginal investment required to open up data. The main stumbling blocks remain political will and

[166] Some of the recommendations are not official views of the sponsoring organisations, nor even majority views among the contributing researchers of this report. In particular, the suggestions around open licensing requirements, open data and corruption, releasing lower-quality open data micro-datasets, or the moral imperative around use of private data for the social good reflect the personal views of the lead author. He hereby graciously acknowledges the intellectual latitude awarded by the sponsors in order to stimulate intellectual and policy debate around these issues.

leadership to override the inertia, resistance and sometimes unfounded fears within the government ministries, departments, and agencies. It must be acknowledged that there are real and valid obstacles to opening up data: privacy is a huge issue when releasing micro-data, and anonymisation and quality control processes are non-trivial as well as resource intensive[167]. Despite this, the value proposition of open data remains too big to ignore: the core impacts achieved to date are transparency and service delivery advocacy, but with the right datasets, more economic and social impacts can be achieved[168]. It remains vitally important that the case for the value and impact of open data be made continuously and keep being reinforced. "Without more evidence and fact-based analysis, the case for open data – for data 'owners' to release it and for users to access it – may weaken, especially as the case of the potential harm starts to overshadow all debate" (Van Schalkwyk et al, 2017, p.12).

Promote a shift in culture around the importance and ownership of government data

For the open data phenomenon to become institutionalized, two organisational culture shifts are essential: firstly, the intrinsic value of data as a strategic and social asset should be recognized by all the stakeholders in the data value chain, including those who capture the data (but often don't see the importance of quality data) as well as managers and decision makers at all levels of the government institutions. Secondly, perhaps more importantly, any sense that data belongs to a specific government department should be challenged. *"Data belongs to the citizen, not to the government […] Recognise in all we do that [Public Sector Information], and the raw data that creates it, was derived from citizens, by their own authority, was paid for by them, and is therefore owned by them. It is not owned by employees of the government. All questions of what to do with it should be dealt with by the principle of getting the greatest value back to citizens, with input not just from experts but also citizens and markets"* (Shakespeare, 2013, p.5). Interestingly, this very same sentiment is also explicitly referred to in South Africa's Pricing of Spatial Products and Services Policy (CSO Policy No 2 of 2013) which lists "promote Batho Pele principles in the use of data" as an important objective.

Move the emphasis in Open Government Data projects from inputs and outcomes to impacts

In too many cases, the emphasis is on the type of activities undertaken and a count of quantifiable outputs e.g. a number of workshops and participants held or count of datasets released. Although these may be an impaortant starting point, *"[c]ounting datasets is a poor way of assessing the quality of an open data initiative. The datasets published on portals are often the datasets easiest to publish, not the datasets most in demand. Politically sensitive datasets are particularly unlikely to be published without civil society pressure"* (Davies, 2014, p.1). Without foregoing proper financial governance and outcome accounting, open data initiatives should also be required to report – and be evaluated – on their short-term visible and longer-term expected impacts: workshops should be evaluated against initiatives or engagements sustained after the workshop has ended; the usefulness of datasets should trump the size or number of them and any programmes should be evaluated against their sustainability and institutionalization[169]. *"It is important to distinguish between different types of results, and the different kinds of outputs open data initiatives may generate, whether they are outcomes or impacts. For example, open data can result in improved service delivery and citizen satisfaction. A more equitable society could be an example of a longer-term impact of open data"* (GODAN, 2018).

[167] There has been an increased concern about privacy issues in the space of open data. Refer to Cannatici (2018), but also the comment below around the necessity of balancing privacy with the social good.

[168] Refer to https://www.scidev.net/global/data/opinion/open-data-people-innovation.html for a discussion on balancing economic with social impact.

Query the need for strict open licensing

Several open data reports actively push for governments to adopt the Open Data Charter and, specifically, to ensure that datasets are open by default and appropriately licensed (the "gold standard"). Indeed, clear and unambiguous licenses are important in creating trust and ensuring usability in innovation contexts (refer to the detailed recommendations in *section 5:* Open data publication of core datasets in Africa: findings from the Africa Open Data Index with respect to open licenses). But one must also recognise the numerous open data efforts in Africa where the "gold standard" has not been achieved (i.e. data published without explicit Open License) but impact was nevertheless seen. So, perhaps there is a need to reduce the rhetoric around the importance of formal "open licensing" in order to recognise open data efforts. The lack of a license to use and re-use freely is a crucial barrier in the EU or US, but appeared to be less so for some of the people interviewed here in Africa[170]. Thus, this report would like to nuance the view that *"[to] deliver real change, open data must meet [all] the principles set out in the Open Data Charter"* (World Wide Web Foundation, 2017, p.5)[171]. As Verhulst points out: *"Standards are generally set by early movers, which typically means more developed and resourceful countries; these standards can then set unrealistic or unfeasible expectations for 'late adopters'. The concern is that, instead of scaling and promoting open data, standards and principles may ultimately hamper the exchange of data. Standards should not be seen as apolitical when their application is inevitably both political and varied across many social contexts. We need to remember that the ultimate goal is to improve people's lives by generating insights from data has been made accessible; not just compliance of principles and standards"* (2017, p.4).

Reduce the number of 'official' open data portals

In the 2016 PARIS21 report 'Making Data Portals work for SDGs', Sub-Saharan Africa stands out as the region with the highest number of data portals per country – 158 portals for 46 countries, i.e. an average of 3.4 portals per country. This is by far the highest in the world and contrasts sharply with Western Europe or Asia (with country averages of 1.6 and 1.7 respectively). This not only increases the cost of maintaining these portals and hampers the discoverability of data, but it also poses problems when data on different portals is contradictory. The number of portals needs to be rationalised, and each portal should have a dedicated impact tracking and user interaction mechanism[172 ,173]. When portals are expanded, upgraded, consolidated or newly proposed; widely supported, stable and customizable open source portal platforms such as CKAN or DKAN should be considered instead of proprietary or custom portal software.

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[169] A similar shift has taken place in the government budgeting and management arena with an increasing emphasis on results-based budgeting/management. There is also an increasing demand from donors (and the researcher community, e.g. ICT4D researchers) to make impact assessment explicit part of proposed development projects and interventions.

[170] One reviewer expressed this using the Nigerian urban saying *"ignore what is written on the bus and just enter the bus"*. However, it is crucial to assert here most strongly that, in African countries with curtailed civic freedoms, this license is vital in order to provide legal protection to academics, NGOs, and data journalists.

[171] Perhaps this might explain why, in Africa, only 1 national and no local governments have formally adopted the ODC.

[172] In the words of the PARIS21 report: *"It has been demonstrated that there is very little demand or use of the portals by local users and policy makers. Greater attention should be placed on monitoring the use of portals and promoting them through targeted national user forums. The viability of a product should be based on tangible evidence that portals are contributing to the public discourse on policy and advancing the development agenda by national decision makers"* (p.23).

[173] One may even argue that there should be NO dedicated open data portals, but all government data should be *by default* open and could then be published directly by the collecting agency. Although this would speed up publication and reduce inter-governmental data ownership debates, it might hamper discoverability and lower data quality given that the portal custodians assist in validating, formatting, meta-annotating and anonymizing data.

Release more data relevant to addressing the needs of vulnerable groups

Open datasets, like traditional datasets, still are biased and do not allow for full exploration of the disadvantages faced by marginalised groups. In particular, data is amazingly deficient on, if not skewed against, women and rural populations. Given that women represent half of Africa's population, the lack of data, or bias in existing data, is inexcusable. Key open datasets to support women's advocacy groups are missing e.g. health, budget, education, crime, access and work participation (Brandusescu & Nwakanma, 2018). Where data exist, systemic biases in instrument design or data collection and lack of affirmative legislation tend to under-report the gaps (Buvinic & Levine, 2015). A separate but related issue is that particular focus needs to be given for the disadvantaged to access and use the open datasets.

Debate the balance between the public good versus the protection of privacy and national security

Of course, personal privacy is a fundamental and inalienable individual right, and national security is critical to the survival of society. This is even more so given the threats and occurrences of cyber-attacks and terrorism. Where these are not already enacted, strong local laws should be promulgated protecting the individual's privacy, and particularly also relating to the data held by government and the private sector. Similarly, data security procedures – and proper data governance – should be enforced among all organisations that hold individuals' personal data. Rightly, attention is drawn to the dangers to privacy of opening up data (Cannatici, 2018). However, the individual rights should always be balanced with the good and needs of society at large. Privacy and security should not unnecessarily or conveniently be used as an excuse *not* to open data where this is not really the case or a serious issue, as has been the case in a number of administrative requests. Although perfect anonymization of micro-data is very hard to achieve, there are best practices and tools available. A reasoned and well-considered discussion of where to draw the line should be encouraged, also inviting civil society to partake[174]. Some of this debate is already taking place: OHCHR has produced some guidance on a human rights-based approach to data; the UN Development Group has developed guidance on data privacy, ethics and protection and the UN Global Pulse is also exploring these questions[175].

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[174] For instance, despite South Africa's very stringent 'Protection of Personal Information (POPI) Act, the City of Cape Town managed to publish monthly water consumption data at the *individual* household level on-line in a courageous and largely successful effort to promote community cohesion, effect social norming and gamify the effort to reduction water consumption in the recent drought experience.

[175] https://www.ohchr.org/Documents/Issues/HRIndicators/GuidanceNoteonApproachtoData.pdf; https://undg.org/document/data-privacy-ethics-and-protection-guidance-note-on-big-data-for-achievement-of-the-2030-agenda/; https://www.unglobalpulse.org/news/building-ethics-privacy-frameworks-big-data-and-ai-report-un-global-pulse-and-iapp

Involve users and other stakeholders in open data decisions; release more lower-quality datasets with explicit quality indicators and implement feedback mechanisms for crowdsourced quality improvement

Too much of the open data supply space is dominated by NSO's statisticians and economists, who are professionally bound to uphold the gold standard for data quality. NSOs, with their applauded and proper attention to absolute perfection in creating core statistics (unemployment, inflation rate, GDP), apply these very same quality standards to all datasets. Thus, only thoroughly verified data is made available, often after significant delays due to the consolidation and validation processes. Not surprisingly, very few datasets meet their criteria and are, sadly, often not deemed fit for release as open data. While not advocating the release of shoddy or bad data, it is important to acknowledge that no data will ever be perfect, and aiming for the highest possible quality will eliminate a large number of very useful datasets, and slow the release of the few that eventually meet the strictest quality criteria to a point that they may already be outdated on their release[176]. This report advocates the embrace of multiple levels of quality for different types of datasets. *"The perfect should not be the enemy of the good"* (Shakespeare, 2013, p.11). Managers in private corporates make strategic and operational decisions all the time using vast real-time, imperfect datasets; their competitive environment moves too fast to allow them the luxury of waiting till definitive, validated data is obtained (if that is indeed deemed possible). Despite the political constraints of opening less than perfect data, in many cases imperfect, timeous data is better than no or "too-late" data.

Mechanisms must be found to release imperfect datasets, perhaps to a more restricted audience who are experienced and trusted to understand the subtleties, along with quality annotations. The feedback role of crowdsourcing to point out and possibly improve low-quality or suspect data could also be explored more aggressively, e.g. for educational, environmental or health micro-data. However, this shift in mindset will not happen as long as the decisions around which government datasets to open are made by statisticians and economists accountable directly to politicians. Data analysts, business intelligence professionals, social scientists and domain experts as well as users need to inform this debate at the very highest levels. Not enough attention and real power are given to forums where all open data stakeholders can share their views and provide inputs on the national open data plans and strategies; where these forums are called as part of the due process, the recommendations often fail to be acted upon. Again, an understanding of the political dynamics and context is often called for, but there are too many useful government datasets which are not opened despite having a relatively low political sensitivity/risk but potentially a large development impact: geospatial data (including detailed cartography); weather and other environmental data; anonymized census data; population, company and property registers; transport data (vehicle and routes); etc.

"A National Data Strategy for publishing [Public Sector Information] should include a twin-track policy for data-release, which recognises that ***the perfect should not be the enemy of the good****: a simultaneous 'publish early even if imperfect' imperative AND a commitment to a 'high-quality core'. This twin-track policy will maximise the benefit within practical constraints. It will reduce the excuses for poor or slow delivery; it says 'get it all out and then improve'." (Shakespeare, 2013, p.11)*

[176] *"There are still major gaps in developmentally-actionable data that is reliable and comprehensive. National Statistics Offices (NSOs) are still the 'guardians of the vault' in this regard"* (Acevedo-Ruiz & Peña-López, 2017, p.12) in their discussion of harnessing the data revolution for sustainable development.

Continue financial and technical support for the early phases of quality open data production through long term partnerships

African governments still need financial and technical assistance. The political reality is that many African governments and politicians are faced with a hard sell when having to allocate resources (i.e. budget) with urgent issues such as health, education, food, clean water and employment, versus open data initiatives. Even if they realise the benefit of accurate data to optimise decisions and generate substantial efficiency gains, it requires a significant amount of political capital to push this through. In the spirit of SDG17, it is suggested that this is a particular area in which the international development community and major donors can intervene, partner and lend support, even if they face a similar (but less intense) "hard sell" with their constituencies. However, any external support must be contingent on local capacity building, partial co-funding, institutionalization, long term financial and technical sustainability, and real impact assessment.

"[D]onors could finance a larger share of the costs in the early stages of data production. As domestic resources expand and institutional capacity grows, that share would decline. Additional incentives to increase demand through open data access, participation in regional programs for standard setting, and additional capacity support could be built into the compact. Focus on results and open data access. Too many statistical support programs focus on inputs and outputs rather than results. There is also weak demand for data production. Opening data to public access could address both problems. Public scrutiny by users and policymakers could help improve quality and increase accountability. Knowledge production externalities would follow, as research using the data expands." (Beegle et al, 2016, p.50)

Support and strengthen National Statistics Offices as the key drivers of national open data initiatives

NSOs should be the primary custodians and drivers of national open data agendas and policy implementations. Sadly, they are often increasingly resource-constrained: given the context of most countries where the more immediate and highly visible health, hunger, education and other issues receive priority in national and international funding decisions, their resource allocations tend to shrink rather than grow. To cut a significant slice out of an already shrinking cake to step up open data efforts is a tall order. This is despite the fact that open data clearly contributes directly to the achievement of many of the SDGs (as illustrated in section 7), and that better and more open data significantly contributes to the measurement and optimal allocation of government spending[177]. Therefore, this remains a call to arms for the long-term-view of international organisations to assist, but with an increased emphasis on sustainability through institutionalisation and internal capacity building, as well as concrete impact measurement (i.e. do not focus on the number of datasets to be opened but rather open fewer but more needed datasets). NSOs should also participate in, if not drive, initiatives in the wider open data ecosystems: *"Kenya has had several open data activities, but with very little participation from the Kenya National Bureau of Statistics, which has limited the impact to date. NSOs are, or should be, the major implementing partners of open data; their support and leadership are critical"* (IODC16, 2016, p.26).

[177] Hence the strong emphasis in the 2030 Agenda on strengthening statistical capacity under SDG17.

Build open data capacity and change the prevailing (lack of) data culture in government

Even though NSOs may be the primary custodians and drivers of open data, a change of mindset and capacity building in other government departments is critical to the success of open government data projects and policies. Top government officials and politicians need to buy into the objectives of open data. There needs to be clear guidelines, policies, governance and education around data management – not just open data but around privacy, protection, cyber-security, archiving, and quality standards. Given that the users of data are often not those who capture the data, the 'data mindset' needs to be communicated among all those who handle data, especially those at the 'coal-face' of data capture. The role of data scientist needs to be introduced at all tiers and in all areas of administration. Governments should ensure that university and other education or training providers include data science into their curricula; this is particularly applicable to the public administration schools. Effective mechanisms for breaking down the (distrust and lack of cooperation between) silos and promoting the sharing of data need to be created. Open data practices need to be implemented using best practices in change and process management. Where successful, these practices need to be institutionalized and shared with other departments. Finally, linkages between civil servants and civil society need to be promoted, perhaps initially on a per-project basis, in order to build networks, communities of practice and trust.

Promote more local and urban government open data initiatives

One of the crucial success factors of open data impact is locally relevant data; thus this data is often available, concentrated and of particular relevance in urbanised areas. *"The local is important in the context of open data. In decentralised contexts, the local is where data is collected and stored, where there is strong feasibility that data will be published, and where data can generate the most impact when used."* (Canares & Shekhar, 2015, p.4). Urban areas also pose specific issues and opportunities due to the density of infrastructure and concentration of resources (e.g. transport, environment, services). Given that it is easier to get buy-in from stakeholders to resolve local issues with locally relevant data, the typical 'national government first' approach may need to be revisited[178]. Local governments, in some cases those governing major cities, may be lower-hanging fruit and easier to convince of the benefits of open data, thus leading the way to a more national approach. The Canares & Shekhar (2015) report explores this through 8 cases, although only one in Africa (and that case actually just refers to local data on the national portal). In this report, this has been illustrated with the example of Cape Town – where the open data initiative has been gaining momentum in contrast to the stalled national open data implementation; however, the Edo State in Nigeria is another example. A city approach was also advocated by the OPAL user group which made it one of their recommendations (Canon, 2017; also see: Canares & Shektar, 2015). Similarly, the role of open data in strengthening the urban resilience was explored with open data crowdsourcing emerging as a strong option: *"The ability to ingest crowdsourced data, and turn data into actionable information is a trait of engaged administrations and data programmes that leverage platforms to harness new data and feedback on local issues. This includes the ability to allow partners to stream sensor-based data to a city's open portal."* Sifa Mawiyoo, Open Data Geospatial Technologist, ICT Authority, Kenya (Landry et al, 2016, p.20). Regrettably, one implication of promoting urban open data initiatives is that it risks further marginalisation of the usually already disadvantaged rural population.

[178] The need for local government data initiatives, as well as not focussing on just top-down but also bottom-up and middle-out open data initiatives was already highlighted in the Open Data in Developing Countries' report insights (ODDC, 2014, p3)

Recognise that the priorities of the global North are not the same as those of Africa

The stated top goals of Open Government Data in the global North are transparency, economic development and innovation. However, in Africa, social needs, service delivery and reducing the gap with disadvantaged communities are at least equally deserving objectives of open data, often easier to achieve and, in young democracies, it is politically far less sensitive to release those relevant data sets. Although the SDGs align well with Africa's Agenda 2063 and, to a lesser extent, various national development plans, the emphasis and relative priorities differ. Recently, more attention is being given by international funding agencies to putting the needs of the local citizens and communities above those of the international community; however, this shift in focus is not always embedded yet in the concrete OGD interventions and policies.

In particular, it cannot just be assumed that creating economic growth should be a key priority for open data in Africa. The Open Data Barometer (2016) report *"found some evidence that open data is contributing to economic growth and the creation of new businesses, but little or no evidence that it is contributing to social inclusion (whether by enhancing excluded groups' access to public services or increasing their participation in policy decisions). While it is great news that open data is helping to create jobs and growth, we should not simply assume that a rising tide lifts all boats"*. In fact, they give examples that even the opposite can happen: open data can be used to increase the gap between haves and have-nots: *"Recent examples of open data being misused include the use of open court records to blacklist low-income tenants […], and the unforeseen erosion of women's informal land rights as a result of the expansion of formal land registries"*.

Pursue a balanced, context-sensitive approach to the issue of transparency and open data

Transparency and accountability are key objectives of many open data projects. Corruption is an immense drain on many economies, but also often a politically delicate issue to address. In 2015, the G20 Anti-Corruption Open Data Principles were adopted to *"enhance access to, and the release and use of, government data so as to strengthen the fight against corruption"*. Given that almost no African government subscribes to the underlying International Open Data Charter, it will be a long while before a representative fraction of African governments adopt these. Without wanting to excuse or condone it, the political reality is that corruption is pervasive and systematic in many African economies; and not just among governments but also in the private sector, with large multinationals headquartered in the north often tacitly or explicitly contributing to the problem: there are always (at least) two parties in corrupt transactions[179]. Where it is pervasive or a "cultural norm", it takes serious political leadership for any top government official trying to reduce it.

An overzealous international community pushing the agenda too hard or fast without considering the contextual realities could destroy any political capital and undo progress already made. In this case, slow but steady incremental progress made in releasing the required datasets is to be applauded and supported. The important role of crowdsourced data (e.g. CorruptionWatch) must also be acknowledged and supported, but perhaps this agenda is best driven by different agencies.

Nevertheless, it is crucially important to acknowledge that open data is a strong mechanism and tool to curb corruption. A recent study shows a high (0.8) correlation between open data and perceptions of corruption at the country level, with the caveats that correlation does not imply causality and, also, that much (though not all) of the correlation disappears when correcting for the country human development level (Vrushi & Hodess, 2017). Indeed, as the study points out, *"[the] two fields, anti-corruption and open data have been developing independently of*

[179] And of course, corruption is endemic in many non-African countries, even among certain EU member states. The reader is referred to the Corruption Perceptions Index for some indicative global statistics (bearing in mind the material difference between perceptions and realities) but warned that, in many non-African countries, corruptive practices exists but under different guises.

each other, thus missing crucial opportunities for value-added through harmonisation. In order to create a well-functioning anti-corruption regime, there needs to be a targeted effort to connect open data to anti-corruption efforts." This serves as a renewed call to arms to harness the power of open data to fight against corruption, but simultaneously to remain sensitive to the (enormous variety in) political realities and contexts of the respective countries. The easiest is to start with embedding public accountability and transparency into projects that are part-funded externally so that all stakeholders, and especially the intended beneficiaries, can verify that activities are implemented as planned.

Further, it must be remembered that there are different impact pathways for open data: achieving better citizen service delivery (health, education, civil registrations) or promoting innovation require, on the whole, different datasets than those for obtaining transparency and accountability. In some countries, starting with the former may be a more achievable route to getting an open data project off the ground than trying to have datasets released which require huge amount of social or political capital from the government's policy or decision makers. Less politically charged but immensely valuable datasets may include detailed geographic data (e.g. GIS data), detailed and longitudinal weather information, organisation registers, agricultural and much of the administrative data. Although this report does not dispute the enormous issue of, and welfare drain stemming from corruption, it suggests that starting with low-hanging fruit may often constitute a more pragmatic route to institutionalizing open government data policies and culture.

Engage in a critical debate around the use of private and corporate data for the social good

Technical platform companies, financial organisations, retailers and telecommunications companies hold huge datasets which have demonstrated the potential for advancing the social good. Without wanting to usurp the sovereignty and competitiveness of these companies (not all of whom are privately owned – many are partly or wholly state-owned), the debate about the moral and practical implications of using this data in the pursuit of socio-economic must be explored. Philosophers and lawyers need to sit together and look at the ethical issues; data scientists, IT specialists and CIOs need to discuss pragmatic options. **Data philanthropy,** the selective opening of data within a safe firewalled corporate environment with support of the sponsoring business' tools and human resources, must be promoted much more aggressively as a form of corporate social responsibility. Possible alternatives that address privacy and competitiveness concerns, such as the **Open Algorithms** approach, need to be explored as well. In other words, instead of giving access to datasets, researchers provide the data analysis code which is validated and run inside the firewalled private data centre under the full control of the data sponsors. More initiatives like the OPAL project in Senegal (and Colombia) should be encouraged. These initiatives are not limited to privately owned organisations: even government departments that are reluctant to make their data public due to privacy or legal concerns could consider the *"provision of 'sandbox' or secure environments in specialised locations […] to allow [users] to explore datasets"* (Deloitte, 2013, p. 32).

More recently, the thinking has evolved to the setting up of **data collaboratives** where corporate (and perhaps governmental) owners of data share these under controlled and trusted arrangements solely for purposes of the social good with vetted and committed actors e.g. researchers, civic organisations, NGOs or government agencies. These data collaboratives would be driven under a **data stewardship** model but, although there are some successful (and possibly even more unsuccessful) cases, more research, experimentation, commitment and engagement is required by all players concerned. As a backstop, governments and the private sector should start an engagement with the possibility of introducing a **"data tax".** This is not meant in the traditional sense (e.g. as advocated currently in EU), relating to a financial tax on data-oriented tech companies that collect data and derive the bulk of their income from it. However, it is introduced here as an 'in-kind' tax full required it to be made available in some form for the social good, from a current context whereby corporation claim unlimited ownership of citizen and community data by sole virtue of having collected it, without being prepared to share it to enable the derivation of social benefits.

Provide more micro-grants and support for open data intermediaries and demand-side stakeholders

Most interventions and resources engage with the supply-side of open data, typified by grants to national governments to create an open data platform; these funds are often linked to a target number of datasets. However, 'build it and they will come' approach does not work in resource-poor societies. The role of intermediaries and the development of a vibrant, active, varied, creative, multi-level open data ecosystem is vital before open data can make an impact. The asymmetry between a single, large supplier of data and a multitude of small and very diverse users (data journalists, academics, local NGOs, …) naturally poses institutional challenges (corporate culture, bureaucracy, business processes, governance, risk appetite) to the large supra-national donor bodies used to operating in the open data stage, such as the World Bank and UN agencies. Thus, alternative channels need to be found to provide support for the intermediary and demand side of the open data ecosystem, allowing for small grassroots-level projects with fewer formalities and paperwork, fast approval, tolerance for a high failure rate, and flexibility to allow agility. For example the OD4D initiative has managed to do that to an extent with its microgrants[180] and the IDRC also has a good track record of managing smaller grants[181].

"The current approach centred only on open data portals is not working. Data portals have left behind a ghost town of open data projects. Although the open data community has been discussing this issue for a long time, it has been unable to improve the situation."
(Open Data Barometer, 2016, p.27)

Set up a data infrastructure to share information, research and best practices around using data for the SDGs

Although research in the use of open data, and data in general for the SDGs, has exploded, alongside a flurry of reports in the international agency and consulting space, this information is spread widely and is often not integrated. If we want to move forward and really harness the data revolution and the power of data as an asset, we need to 'walk the talk', i.e. we need 'better data about data': what works and what doesn't? Who does it? Where and how? What scales and what doesn't? What helps with achieving SDGs? Who researches it? What are best practices and who are the skilled practitioners? Currently, information is collated in periodic or one-off research reports (indeed, like this one). But, like for the SDGs, a continuously functioning **observatory** could be established that monitors, collates and disseminates activities in the open data space on an ongoing basis (Verhulst, 2018b). Ideally this would be a joint venture between some of the key actors already in this space. As recommended in the ODB section of the report, there is a specific need to build an open data knowledge network within Africa.

[180] And, in their 2017 evaluation of OD4D, this became a key finding: *"Most results have been on the supply-side of open data; there is a need to increase demand-side results (so less emphasis on the Open Data and more on the 4D)"* (Acevedo-Ruiz & Peña-López, 2017). However, later they shift their position and propose to focus on the intermediaries (meso level) instead of the end users (micro-level).

[181] Although the larger funding agencies have recognized this to an extent. For instance, an example where the World Bank supports small but efficient open data projects (via the GFDRR) is Open Cities Africa project, aiming to build urban resilience.

Involve and incentivize academic involvement

In most of the case studies (except for Burkina Faso and South Africa), the involvement of local academia in open data is found to be quite low. This can be attributed to a relatively low level of research (itself a consequence of low research capacity, funding and focus) and scare financial and human resources in much of Africa's Higher Education sector. This leads to huge academic workloads and an emphasis on teaching instead of research. However, academics should take an intellectual leadership role in the African open data community: apart from researching the phenomenon, they can be both producers and consumers of open data. They are an easily identifiable group to target, and perhaps even easier to incentivize given the often relatively modest requirements for research. So specific teaching and research programs for using and creating open data for the SDGs should be created. These would include data science internships in open data and related government departments or with data journalists. It is also vital to include (open) data courses as part of any public administration curriculum. These teaching and research programs could be developed with private sector involvement (refer to the discussion on data philanthropy, open algorithms and data cooperatives). The potential usefulness of this type of initiative was amply demonstrated in Orange's Senegal and Côte d'Ivoire D4D Challenge.

A second approach is to encourage the use of open data to teach data analytics courses. This will not only create generations of highly skilled data professionals which are crucially needed in the private and public sectors across the continent; but they will also instil the ethics of using (and, hopefully, creating) open data in these young specialists. The creation of academic data analytics programs is a necessity, in any case, to supply the needed human resources for Africa's new economic challenges, so this would just tweak the programme to provide easy-and-cheap-to-access but realistic datasets.

Strengthen and protect data journalism

Finally, "last but not least", the continent's unsung heroes of the open data impact are the journalists who have used open and other public data to call corrupt or resource-wasting governments to order, played activists on behalf of disadvantaged communities, given voice to those who could not understand or speak, and promoted peaceful democratic processes by their electoral reports. On top of hectic publishing schedules, with only minimal resources and incentives and sometimes facing realistic threats, a few have courageously gone and pursued factual data and tried to mediate these to make them understandable to the often less data-literate citizens. The laudable initiatives and support structures for data journalists (and a select few of their media outlets) should not only continue to be supported, but ways of enhancing and extending the support more realistically should be explored. Their freedom to be the (fact-based) voice of the community should be protected, in law and in practice. Additionally, they should be encouraged to do data journalism through international prizes (with meaningful financial rewards attached); practical and logistical support by means of tools and local or remote (online) data scientists/interns; and lift-outs to sponsored training workshops.

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A2K4D: http://schools.aucegypt.edu/Business/A2K4D/Pages/default.aspx

Abelobi: http://abalobi.info/app-suite/

AfDB has created a Gender Equality Index: https://www.afdb.org/en/topics-and-sectors/topics/quality-assurance-results/gender-equality-index/

Africa Open Data Network (AODN):

African Legal Information Institute (AfricanLII): https://africanlii.org

African Network of Centers for Investigative Reporting (ANCIR): https://investigativecenters.org/

African Open Data Conference: https://africaopendata.net

Afrinype: https://www.afrinype.org

AidData: https://www.aiddata.org

Akvo: https://akvo.org

BeogNeere: https://beog-neere.org

Burkina Open Data Initiative (BODI): http://www.anptic.gov.bf/index.php/projets/le-bodi

Carteau: http://carteau.gov.bf

Catalogue d'idées de réutilisation des données ouvertes (CIRDO): http://cirdo.data.gov.bf

CKAN: https://ckan.org

Code for Africa: https://codeforafrica.org

Code4Africa: https://africaopendata.org

Congo Basin Forest Atlases: https://www.wri.org/our-work/project/congo-basin-forest-atlases

Creative Commons Attribution license: https://creativecommons.org/licenses/by/4.0/

Data Science (Kenya): http://www.datascience.co.ke

Data Stewards Network: https://datastewards.net

Data Wazi: https://www.youtube.com/watch?v=Yf7uc1Rx04I

Dataforces: http://www.dataforces.woelab.tg/

Directory of Open Access Journals (DOAJ): http://doaj.org

DKAN: https://getdkan.org

Education Open Data Dashboard (Tanzania): http://educationdashboard.org

Eduweb (Kenya): http://www.eduweb.co.ke

Energy Sector Management Assistance Program (ESMAP): http://www.esmap.org

Esoko: https://www.esoko.com

ESRI-Rwanda: https://www.esri.rw

Explore Data Science: https://www.explore-datascience.net

Farmerline: https://farmerline.co

Follow-the-Money (Nigeria): https://followthemoneyng.org

Francophone Africa Open Data Conference: https://www.opengovpartnership.org/stories/cafdo2017-la-premi-re-conf-rence-d-afrique-francophone-sur-les-donn-es-ouvertes-et-sur-le

Ghana International Network for Knowledge Sharing (GINKS): https://www.facebook.com/GINKS-599702606735277/

Global Open Data for Agriculture and Nutrition network (GODAN): https://www.godan.info

Global Open Data Index (GODI): https://index.okfn.org

Global Partnership for Education: https://www.globalpartnership.org

GlobalFishingWatch.org (GFW): https://globalfishingwatch.org

GotToVote!: https://kenya.gottovote.cc

Governance Lab (GovLab): http://www.thegovlab.org

Handeka: https://www.facebook.com/events/1616991688330604/

Humanitarian OpenStreetMap Team (HOT): https://www.hotosm.org

IHI: https://ihi.or.tz

iHub: https://ihub.co.ke

Insight2impact (i2i): http://i2ifacility.org

Institute of Policy Analysis and Research-Rwanda (IPAR-Rwanda): http://www.ipar-rwanda.org

Interactive Forest Atlas of the Democratic Republic of Congo: https://www.wri.org/resources/maps/forest-atlas-democratic-republic-congo

International Livestock Research Institute (ILRI): https://www.ilri.org

International Open Data Charter (IODC): https://opendatacharter.net

iParticipate (Uganda): http://cipesa.org/tag/iparticipate/

Korbitec: http://www.korbitec.ca

MapKibera: http://mapkibera.org

Marocviz: http://www.marocviz.ma/home

National Compendium of Women Competencies (COCOFCI): http://www.competencesfeminines.gouv.ci

National Farmers Information Services (NAFIS): http://www.nafis.go.ke

NationMaster: http://www.nationmaster.com

NewsPlex: https://www.nation.co.ke/newsplex

Nos Écoles, Nos Données (NENDO): http://nendo.gov.bf

Ntatenda: https://ntatenda.com
Odekro: http://www.odekro.org

Open (Data) Definition: https://opendefinition.org

Open Burkina: https://www.openburkina.bf/

Open Cities Africa: https://opencitiesproject.org

Open Data Barometer (ODB): https://opendatabarometer.org

Open Data Cape Town: http://opendata.capetown.gov.za

Open Data Day: http://opendataday.org

Open Data Durban: https://opendata.durban

Open Data Edo State (Nigeria): http://data.edostate.gov.ng

Open Government Partnership (OGP): https://www.opengovpartnership.org

Open Knowledge International: http://www.okfn.org

Open Knowledge Network: https://okfn.org/network

OpenAIR: http://www.openair.org.za

OpenStreetMap Burkina Faso: https://wiki.openstreetmap.org/wiki/FR:WikiProject_Burkina_Faso

OpenStreetMap: https://www.openstreetmap.org

OpenUp: https://openup.org.za

OroData: http://www.orodataviz.com

PrésiMetre: http://www.presimetre.bf

Reboot (Nigeria): https://reboot.org

REDD+: http://www.un-redd.org

Registry of Open Access Repositories (ROAR): http://roar.eprints.org

SA Cities Open Data Almanac (SCODA): http://www.scoda.co.za/

Sobanukirwa: https://sobanukirwa.rw/

Social Watch: http://www.socialwatch-benin.org

Sustainable Development Goals (SDGs): https://sustainabledevelopment.un.org/sdgs

Tacid Network: http://documents.rec.org/events/TACID_NETWORK.pdf

Tanzania Data Lab: https://dlab.or.tz

Tanzania Office de la Topographie et du Cadastre: http://www.otc.nat.tn/index.php/projets/geoportail-cadastral

TechMousso: http://techmousso.ci

TRACTOR: https://tractorghana.wordpress.com/about-tractor/

Transforming Rural Agricultural Communities through Organic Re-engineering (TRACTOR): http://www.tractor-gh.org

Uchaguzi: https://www.ushahidi.com
U-Report: http://ureport.ug

West African Election Observers Network (WAEON): http://www.waeon.org

WikiData: https://www.wikidata.org/wiki/Wikidata:Main_Page

Wisdom, Africa Open Data and Internet Research Foundation (AODIRF): http://www.aodirf.org

Women of Uganda Network: http://wougnet.org

World Bank (Education): https://data.worldbank.org/topic/education

World Wide Web Foundation: www.webfoundation.org

ECA

www.uneca.org

OpenData for development network

www.od4d.org

UNDP

www.undp.org

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