



ADOPTION OF OPEN GOVERNMENT AND FRAMEWORK FOR BIG DATA ANALYTICS IN NIGERIA.

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Abstract

Over the last decade an increasing number of citizens around the world have demanded that their fundamental right to engage in policy making and policy implementation be recognized and that their governments become more transparent and accountable. Responding to recognition of the rights of citizens, governments across the world have embraced the concept of Open government. Consequently, this has led to a growing global trend for government data to be released to the public as ‘open data’. Across the public sector, extraordinary quantities of data are amassed in the course of delivering public services and this has signaled a shift towards a data-driven socio-economic model, commonly referred to as “big data”. Governments around the world are posting many thousands of their datasets on online portals. A major purpose of releasing this data is to drive innovation through Big Data analysis, as well as to promote government transparency and accountability.

This paper aims to consider the adoption of open government and propose a framework that will incorporate big data analytics to streamline and advise decision makers on topical issues in Nigeria.

Keywords-Open government, Open data, Open government data, Big Data, Big Data Analytics



I. Introduction

The rise of modern information and communication technologies (ICT) in recent years has laid the foundation for a new era of democracy that is capable of leveling up the transparency of governmental action, the political participation of citizens and the collaboration between governments and citizens. These three aspects are widely regarded as the principles that constitute the concept of open government (Andersen et al., 2010), which rapidly gained significant attention from the public and the scientific community. Over the last decade an increasing number of citizens around the world have demanded that their fundamental right to engage in policy making and policy implementation be recognized and that their governments become more transparent and accountable. Responding to recognition of the rights of citizens, governments across the world have embraced the concept of Open government (Odongo & Rono, 2016). Since President Obama's Memorandum for the Heads of Executive Departments and Agencies in March 2009, open government has attracted enormous public and scholarly attention. Open government has become popular also in other parts of the world, including the European Union, Australia, New Zealand, as well as China and Russia. All this indicates that "Open Government is entering a new phase and becoming an important global agenda" (Lee & Kwak, 2012). Government agencies produce information in form of documents and data and if made available can be referred to as OGD or open data. OG requires open data (OGD) as a precondition and enabler. OGD and OG together play a role in 'Good Governance' by laying the foundations for new relationship between government and citizens where all stakeholders work together for the good of society.

Since 2011 the initiative of Open Government Partnership (OGP), launched by Obama and seven other heads of state, has grown from 8 to 65 participating countries with Nigeria joining as the 70th country in July 2016 (OGP, 2016). Countries who join the OGP must develop an action plan on open data, prepare yearly self-assessments on how that plan is being implemented, and submit to the OGP's Independent Reporting Mechanism. Nigeria's national action plan spans four thematic areas which include fiscal transparency, anti-corruption, access to information and citizen engagement. Governments committed to the open data movement are posting many thousands of datasets on online portals. The purpose of releasing this data is not merely (or even primarily) to provide information to the public, but rather to encourage citizen participation and drive innovation to solve complex policy problems through 'Big Data' analytics. In Nigeria, with about 170 million population, the challenges of data collection and mining is surely a challenge particularly with various organs of government that are involved in the management and usage of data for different purposes. Hence there is a need for the adoption of a big data analytics framework in open government especially in resource-poor settings like Nigeria.

The aim of this paper is to consider the adoption of open government and propose a framework that will incorporate big data analytics to streamline and advise decision makers on topical issues in Nigeria. The next section describes technology use in government and the third section discusses the theoretical concept of open government. The fourth section explains the open data movement and how this relates to the phenomenon of Big Data. The fifth section describes the sources of big data in Nigeria and the use of big data analytics. The sixth section discusses a conceptual framework for big data analytics in open government. Finally, the last section considers the benefits and risks of releasing government data as open data.

II. Technology in Government

Modern-day Information and Communication Technologies (ICTs) offer lots of potential for the public sector to support services, government administration, democratic processes, and relationships among citizens, civil society, private sector, and the state (Dawes, 2008). E-



government research, which has been advancing since 1990s, has been reporting generally positive results (Andersen, *et al.*, 2010). In practice in certain areas e-government has clearly managed to make public services more efficient; for instance, in the EU the top three most used e-government services are declaring income, declaring change of address, and enrolling in higher education (Capgemini, 2014).

The spread of social media and web 2.0 in the first decade of 2000s has brought about significant changes in the ways information is created, shared, and processed in society. Different niche paradigms have emerged within the e-governance field as a response to these technological developments: government 2.0, e-government 2.0, social-media-based government, smart government, collaborative government, networked governance, do-it-yourself government, open government. The latter is the paradigm which has most prominently featured in governmental policies around the globe in the past few years.

III. The Theoretical Concept of Open Government

The idea of open government in general is not a new concept and has historically been used in various contexts, including freedom of information, anticorruption, and transparency (Nam, 2012; Chapman & Hunt, 2013). However, information and communication technologies (ICTs) have changed the preconditions for information sharing, and created technical possibilities for a more collaborative information production and sharing culture. As ICT has become more prevalent and part of our everyday life, the focus has shifted from the technology itself to how we use it. The concept of open government means the focus is not so much on the technology but on the interoperability, openness, and participatory dimension that the technology might enhance, as well as on a fundamental change of how governments operate. It can be seen as a development of the e-government field that has been criticized for being largely focused on improving government services, and for not looking at the transformation of the government as a whole toward a more participatory democracy (Heeks & Bailur, 2007; Wimmer & Scholl, 2007; Yildiz, 2007).. In all documents, focus is on transparency and understanding, and public participation is seen as a central means to gathering information

Since 2008, a rich body of open government literature has emerged in peer-reviewed journals, alongside a high number of non-peer-reviewed publications. Yet in general, open government is still an evolving field of research. Thus, the treatment of open government in the literature is very heterogeneous with regard to research discipline, topic, country of interest, and content. Given this context, a unified concept of open government has not been clearly elaborated in the literature. In fact, the literature has no clear understanding of what the term open government captures in general and lacks even basic and integrative definitions.

There is a dearth of integrative open government definitions in literature. Nonetheless, some integrative definitions of the term open government were identified in the literature. The Organization for Economic Co-operation and Development (OECD) understands open government as the transparency of government actions, the accessibility of government services and information and the responsiveness of government to new ideas, demands and needs (OECD, 2009). [6] note that open government consists of transparency, participation, and collaboration of the state vis-à-vis third parties such as businesses or citizens.

Meijer, Curtin and Hillebrandt (2012) perceive open government as the extent to which citizens can monitor and influence government processes through access to government information and decision making arenas. Research on open government was triggered by the adoption of open government policies around the world.



The concept of open government has been strongly encompassed and promoted by the Obama administration (Open Government Progress Report to the American People, 2009). The Open Government Partnership which started in 2011 with 8 participating countries, and contains 69 countries as of mid-2016, is an international platform sponsored by private investors and partner states across the world that have committed to defining and implementing shared principles of open government. A key aim of this open data movement is to drive policy and business innovation by allowing entrepreneurs to create value from government data by developing new businesses around the data assets in a crowdsourced manner (Najafabadi & Luna-Reyes, 2017)

There have been a few attempts by researchers to develop models of open government to characterize and depict the dimensions of open government (Meijer *et al.*, 2012) to envision the process of adoption and maturity of open government (Lee & Kwak, 2011) to assess and measure its implementation (Bertot, Jaeger, & Grimes, 2010). It is a nascent field with little cohesion theory-wise in the research community. Besides, the overwhelming majority of research contributions focus on open data as an application of open government reforms.

Arguably, the most widely cited model of open government implementation is the Open Government Maturity Model (OGMM) of (Lee & Kwak, 2011). It describes five levels of maturity of open government from the point of reference of increased public engagement. Focus will dwell on open data as discussion ensue in the next section

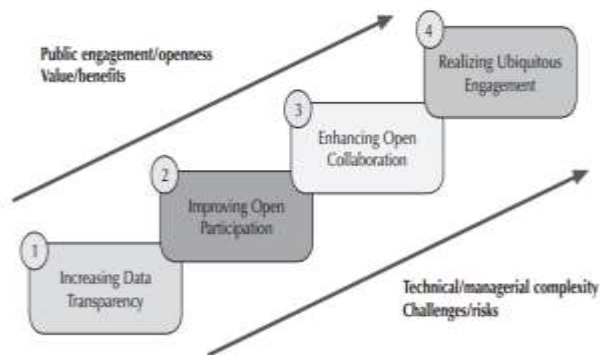


Figure 1: Open Government Implementation Model (Source: Lee & Kwak, 2011)

IV. Open Government Data and Big Data

There is a growing global trend for government data to be released to the public as ‘open data’. Open data is data which is accessible for free or at minimal cost, and which can be accessed by anybody and re-used for any purpose (Ubaldi, 2013). Ideally, this means that the data should be made available online under a creative commons license and in a machine-readable format. Governments committed to the open data movement are posting many thousands of datasets collected by their agencies on online portals and if made available can be referred to as OGD or open data (Odongo & Rono, 2016). These datasets cover a range of topics including spatial, transport and public health data. The key aim of this open data movement is not merely (or even primarily) to provide information to the public, but rather to drive innovation through ‘Big Data’ analysis and contribute innovative solutions to complex policy problems (Odongo & Rono, 2016). Governments are no exception in the modern world and tend to generate a staggering amount of data and larger datasets. Across the public sector, extraordinary quantities of data are amassed in the course of delivering public services, from managing welfare payments and national health services through issuing passports and driving licenses (Yiu, 2012).. While economic and social activities have long revolved around the use of data, the significant volume, velocity and variety of data increasingly being used across the economy, and the important social and economic value



of this data, signal a shift towards a data-driven socio-economic model, commonly referred to as —big data. In this model, data are a core asset for creating significant competitive advantages and for driving innovation, sustainable growth and development (Open Data Handbook, 2012b). So open data must be understood alongside the phenomenon of Big Data. Big Data, although difficult to reduce to a mutually agreed definition, is a popular term which captures the proliferation of large datasets in our technology-driven society, as well as the extraction of new information from large datasets through smart analytical tools.

Not all analysis of open data will involve Big Data analytics, but Big Data analytics rely heavily on open data. In other words, the more government data that is available as open data, the greater the capacity for industry, academia and the general public to contribute to policy innovation through Big Data analysis. Like open data, Big Data ‘enables businesses and governments to make informed, fact-based decisions about the complex world around us, create new products, reduce waste and plan intelligently for the future.

V. Big Data in Nigeria

In Nigeria, with about 170 million population, the challenges of data collection and mining is surely a challenge particularly with various organs of government that are involved in the management and usage of data for different purposes. Some of the agencies that are mandated to collect and manage data in Nigeria include:

- National Bureau of Statistic (NBS) with the official mandate for production of national official Statistics;
- Federal Road Safety Commission (FRSC) for drivers’ license and vehicle number plates;
- National Identify Management Commission (NIMC) for national identity database
- National Population Commission in charge of national demographic data.
- Independent National Electoral Commission (INEC) for voters registration exercise.
- Other organizations including the banks in the financial sector and Telecommunication companies in the telecommunication sector.

Most of these data collected by these organizations are structured in nature and very suitable for current e-governance services. The collected data is used only for statistical purpose and not solving any mission critical challenge that can improve the quality of the government service or schemes (Salisu, 2015). The application of Big Data analytics to this growing resource can increase the value of this asset to government and the people. There is the need to have national ICT strategy that will identify the need to have framework for Big Data analytics so as to further develop government capability in Big Data.

VI. Framework for Big Data Analytics

Big data analytics refers to Data analysis being undertaken that uses high volume of data from a variety of sources including structured, semi structured, unstructured or even incomplete data and the phenomenon whereby the size (volume) of the data sets within the data analysis and velocity with which they need to be analyzed has outpaced the current abilities of standard business intelligence tools and methods of analysis.

Big data analytics can be used to streamline service delivery, create opportunities for innovation, and identify new service and policy approaches as well as support the effective delivery of existing programs across a broad range of government operations - from the maintenance of our national infrastructure, through the enhanced delivery of health services, to reduced response times for emergency personnel and to national planning for economic growth and development. The uses cannot be over emphasized.



In a country like Nigeria with a population of 170 Million, the number of users expected to be utilizing e-governance application and services is assumed to be huge. Effective management and analysis of large-scale data should pose an interesting but critical challenge to Nigerian government. A democratic country like Nigeria public participation as willingness on part of government to share information and make citizens a partner in decision making process and in governance is very important. With proper Big Data analytics, government can offer easy access to diverse and large quantities of data to its citizens.

The Big Data analytics framework is a plan for a Big Data analysis systems and their supporting infrastructure, which maximizes the ability of a business to achieve organizational objectives. Good Big Data analytic framework should be able to support a range of technology with Big Data analysis capability and requirements such as availability, scalability, and high performance. Some important considerations in selecting Big Data application analysis framework include the following:

- Support for multiple data types;
- Handle batch processing and/or real time data streams;
- Support NoSQL and other newer forms of accessing data;
- Overcome low latency;
- Provide cheap storage, and Integrate with cloud deployments.

A Big Data framework for government should be able to support the four (4) basic components of

- Resource management,
- Data organization and management,
- Analytics and discovery,
- Decision support and visualization report.

Below is a typical Big Data analytic framework that can suit any government for Big Data analytics.

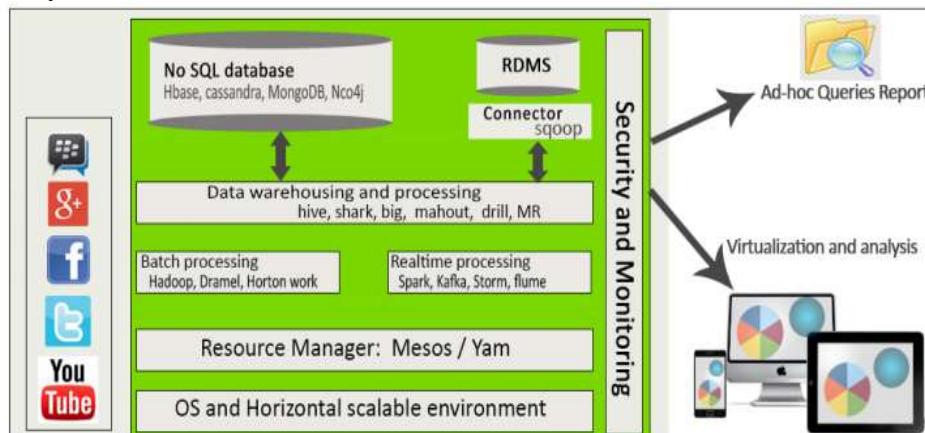


Figure 2: Big Data Analytics Framework

Resource management and scheduling platform - Mesos and Yarn (Apache.org & Hadoop.apache.org): Possess the capability to increase resource utilization of clusters by sharing cluster resources among multiple processing frameworks like Hadoop, Spark, and MPI etc.

Data organization and management level in the diagram above is the software that processes and prepares all types of structured and unstructured data for analysis. Big Data analytics Stack interact with RDBMS through connector – Sqoop. The Sqoop tool above is designed for efficiently transferring bulk data between Hadoop related system (like HDFS, Hbase and Hive) and RDBMS



(like Oracle, MySQL, Postgres, HSQLDB amongst others). In the NoSQL database management system, Hbase and Cassandra are for columnar database, MongoDB for document and Neo4j for graph based No-SQL database. This layer is rich in functions and enough to serve all data type

Data Analytics and discovery is part of the framework design to supports offline and online data processing. The level has two layers with applications like Hadoop, Dramel, Horton Works for offline batch processing on one part and application like Spark, Kafka, Storm and Flume for dynamic real-time analysis on the other part. Data mining and streaming and iterative computations are also carried out on this layer.

Decision, support and virtualization layer is the analysis and reporting layer. It contains tools for user-friendly representation of information from various sources that can be analyzed and used for decision-making. Report can be visualized in a form normal to end user like the general public for analysis and informed decision making.

VII. Benefits and Risk of Releasing Government Data

There are three major benefits associated with the releasing of government data to the general public as open data. First, open data is seen as key to improving the effectiveness and efficiency of government policy and services. For example, data on crops, weather and geography might be analyzed to improve current approaches to farming and industry, or data on hospital admissions might be analyzed alongside demographic and census data to improve the efficiency of health services in areas of need.

The idea is that releasing such data will allow governments to provide better quality services which intelligently target sectors of the population most in need of those services. This will lead to economic benefits if governments can provide the same quality of services at lower cost.

The second major benefit is that open data is making gains in transparency and accountability, as a greater proportion of government decisions and operations are being shared with the public. These democratic values are made clear in the OGP's Open Government Declaration, which aims to make governments 'more open, accountable, and responsive to citizens'.

The third benefit is that open data can improve democratic participation by allowing citizens to contribute to policy innovation.

At the same time, the possibility of re-identification from government data means that the open data movement poses risks to individual privacy. Currently, much of the open data available is spatial (geographic or satellite) data which is relatively unproblematic to post online as it poses minimal privacy risks. However, for the full benefits of open data to be gained, this spatial data needs to be supplemented with information on welfare payments, hospital admission rates, income tax assessments and other potentially sensitive areas of government policy and administration which could drive innovation (Hardy & Maurushat, 2017).

IX. Conclusion and Recommendation

In their day-to-day operations, government agencies produce a huge volume and variety of data about individuals and society. The open data movement aims to release this information to the general public in order drive policy innovation and to improve transparency and accountability.

Countries across the globe are trying to adopt big data technology in various domains like healthcare, crime prevention, agriculture, transportation, education and natural disaster prevention management. Through Big Data analytics, Nigeria can lay solid foundation that can solve the numerous problems militating her much desired and needed progress. Issues of weak economy, un-employment, corruption, insecurity, weak private sector and many more can be tackled securely if we can convert the opportunities offered by big data analytics by making proper analysis that



will guide the leadership to make informed decision, proper economic planning and policy formulation.



References

- Andersen, K. N., Henriksen, H. Z., Medaglia, R., Danziger, J. N., Sannarnes, M. K., & Enemærke, M. (2010). Fads and facts of e-government: A review of impacts of e-government (2003–2009). *International Journal of Public Administration*, 33(11), 564-579.
- Bertot, J. C., Jaeger, P. T., & Grimes, J. M. (2010). Using ICTs to create a culture of transparency: E-government and social media as openness and anti-corruption tools for societies. *Government information quarterly*, 27(3), 264-271.
- Capgemini Consulting. (2014). eGov Benchmark: Delivering on the European Advantage? Retrieved September 4, 2018, from <http://www.capgemini.com/egov-benchmark>
- Chapman, R. A., & Hunt, M. (Eds.). (2013). *Open Government (Routledge Revivals): A study of the prospects of open government within the limitations of the British political system*. Routledge.
- Dawes, S. S. (2008). The evolution and continuing challenges of e-governance. *Public Administration Review*, 68(s1).
- Geiger, C. P., & Von Lucke, J. (2012). Open government and (linked)(open)(government)(data). *JeDEM-eJournal of eDemocracy and open Government*, 4(2), 265-278.
- Hardy, K., & Maurushat, A. (2017). Opening up government data for Big Data analysis and public benefit. *Computer law & security review*, 33(1), 30-37.
- Heeks, R., & Bailur, S. (2007). Analyzing e-government research: Perspectives, philosophies, theories, methods, and practice. *Government information quarterly*, 24(2), 243-265.
- Lee, G., & Kwak, Y. H. (2011). An Open Government implementation model: moving to increased public engagement. Retrieved October 4, 2018, from http://www07.ibm.com/events/au/smartergovernment/pdf/An_Open_Government_Implementation_Model.pdf
- Lee, G., & Kwak, Y. H. (2012). An open government maturity model for social media-based public engagement. *Government Information Quarterly*, 29(4), 492-503.
- M Najafabadi, M., & Luna-Reyes, L. (2017). *Open Government Data Ecosystems: A Closed-Loop Perspective*.
- Meijer, A. J., Curtin, D., & Hillebrandt, M. (2012). Open government: connecting vision and voice. *International Review of Administrative Sciences*, 78(1), 10-29.
- Nam, T. (2012). Citizens' attitudes toward open government and government 2.0. *International review of administrative sciences*, 78(2), 346-368.



- Odongo, A. O., & Rono, G. C. (2016). Open Government Data as a Right for Effective Citizen Participation. In Proceedings of the 9th International Conference on Theory and Practice of Electronic Governance (pp. 365-366). ACM.
- Open Data Handbook. (2012b). What is Open Data? Open Data Handbook. Retrieved 8 October, 2018, from <http://opendatahandbook.org/en/what-is-open-data/>
- Open Government Partnership. (2014). Retrieved October 4, 2018, from <http://www.opengovpartnership.org/>
- Open Knowledge, Open Data Handbook: Why Open Data? <<http://opendatahandbook.org/guide/en/why-open-data/>> (last accessed 13 September, 2016);
- PricewaterhouseCoopers. (2014). Deciding with Data: How Data-Driven Innovation is Fuelling Australia's Economic Growth
- Salisu, K. (2015). E-Government Adoption And Framework For Big Data Analytics In.
- Ubaldi, B. (2013). Open government data: Towards empirical analysis of open government data initiatives. OECD Working Papers on Public Governance, (22), 0_1.
- Wimmer, M. A., & Scholl, J. (2007). Electronic Government: 6th International Conference, EGOV 2007, Regensburg, Germany, September 3-7, 2007, Proceedings (Vol. 4656). Springer Science & Business Media.
- Wirtz, B. W., & Birkmeyer, S. (2015). Open government: Origin, development, and conceptual perspectives. *International Journal of Public Administration*, 38(5), 381-396.
- Wirtz, B. W., Weyerer, J. C., & Rösch, M. (2017). Open government and citizen participation: an empirical analysis of citizen expectancy towards open government data. *International Review of Administrative Sciences*, 0020852317719996.
- Yildiz, M. (2007). E-government research: Reviewing the literature, limitations, and ways forward. *Government information quarterly*, 24(3), 646-665.
- Yiu, C. (2012). The big data opportunity. *Policy exchange*, 8.