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► To cite this version:

Mbongeni Hlabano, Jean-Paul Van Belle. Tracing the Impact of the City of Cape Town's Open Data Initiative on Communities and Development. 15th International Conference on Social Implications of Computers in Developing Countries (ICT4D), May 2019, Dar es Salaam, Tanzania. pp.284-294, 10.1007/978-3-030-18400-1_23 . hal-02285272

HAL Id: hal-02285272

<https://inria.hal.science/hal-02285272>

Submitted on 12 Sep 2019

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Tracing the Impact of the City of Cape Town's Open Data Initiative on Communities and Development

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Abstract. This paper attempts to measure the extent of impact of the City of Cape Town's open government data initiative, which has been operational since 2013. Given the relative scarcity of impact measurement frameworks, a framework is adapted from that of Verhulst and Young[1], as well as the Social Return on Investment (SROI) framework suggested by Stuermer and Dapp [2]. The idea is to trace the developments resultant from the use of open data from various sources, mainly the City of Cape Town's open data portal. Several activities and developments are identified and classified under a classification scheme adapted from development pathways relevant to a developing country context. The development pathways are identified from literature. After the developments are traced, critical impact analysis is carried out using the SROI framework. The findings suggest that although there are some indications of impact, such impact is only confined to groups with specialised and specific interest in various types of open data. Additionally, awareness of the existence of open data-sets is also minimal, which significantly decreases the likelihood of use, ergo, impact. Policy suggestions to increase likelihood of use and impact are then presented.

Keywords: Open Data, Impact Measurement, Development Pathways, Social Return on Investment, Sustainable Development Goals, Tracing Development

1 Introduction

This research looks at the Open Data (OD) phenomenon as a driver for developmental impact and government transparency. Most of the OD research in Africa has focused on national governments; there is currently not a single research study which looks at a local government OD implementation. This research aims to bridge this gap by looking at the OD phenomenon in the first African city to embrace and adopt OD whole-heartedly.

The research objectives are to present the case study of Open Data Cape Town and to assess its impact using a sound theoretical framework. The ultimate aim of the research is to present concrete recommendations on how the open data initiatives can be enhanced to further improve the impact on community development and local government transparency.

2 The City of Cape Town's Open Data Initiative

The CCT 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 [3]. The forum brought together stakeholders interested in open data, which resulted in the idea of establishing an open data policy being suggested. The City Mayor's Office then 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 [3]. The resulting document served as a basis for the eventual Open Data Draft Policy published in February 2014 [4]. The city's open data portal was then launched in January 2015. The portal currently has 119 datasets (as of 02 July 2018) covering several areas including agricultural land, fiscal data, air quality, industrial statistics, and locations of amenities among others. The datasets clearly cover important areas that would be significant in driving socio-economic impact.

3 Other Non-Central Government OD Providers in South Africa

The open data "movement" is relatively nascent in South Africa, although some notable progress to facilitate awareness of the concept has been fostered by some stakeholders. A relevant example is OpenUp (formerly known as Code 4 SA). They are a civil society group advocating for data liberation, data literacy, citizen empowerment, active citizenry, co-governance, and civic technology [5]. 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 [6]. 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 license attached to the datasets.

At local level in South Africa, the City of Cape Town has made the most significant strides relating to open data, as discussed earlier. Other open data initiatives in other major cities have emerged. Open Data Durban [7] 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 civic 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, attending some of their activities, perhaps an indication that the city would also like to develop and launch an open government data initiative [8].

4 The Impact of Open Government Data

4.1 Measuring the impact of OGD

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 [1], or studies that clearly assess impact of OGD in great detail [8, 9]. 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 [8].

The most prominent dimension of impact that has been measured is economic impact, with some studies attempting to quantify the capital contribution open data potentially makes towards economies (e.g. [10, 11, 12]. The Open Data Barometer reported a 14 per cent increase in economic impact for the surveyed countries, whilst also pointing out the least impact on social issues (14 per cent decrease), as well as a decrease in political impact [8]. The actual social impact of open data is most likely higher than estimated in studies that have attempted to measure it. Some studies only give approximate estimates (for specific countries) of the value resultant from the social impact of open data, given the lack of appropriate framework to make more formalised estimates [11].

Given the apparent lack of appropriate framework to measure the impact of open data, some researchers have suggested some frameworks for measuring the impact and social value of open data. Some of these are discussed in the following section and how the suggested frameworks are adapted to attempt to measure the impact of open data for the City of Cape Town’s open data initiative.

4.2 Open data impact measurement frameworks

It has been suggested that context should be considered when assessing the impact of open data [2, 9, 13]. This is particularly relevant for assessing open data initiatives in Africa (or developing countries in general), which has a different political climate to that in the more developed countries in Europe and the Americas. The report from the International Open Data Conference in 2016 suggests that different impacts require different indicators and methods, hence recommending the need for sector specific impact studies [9]. Adopting this recommendation, this research assumes a thematic approach to the analysis and measurement of the impact of the City of Cape Town’s

open data initiative. Themes are identified, and the associated inception points for the actual use of the various datasets on the city's open data portal, as well as other open data sources such as OpenUp. Thereafter, the subsequent activities and the resultant impacts are traced and measured as far as practicable.

It is also important to focus on themes relevant to a developing country context. In attempting to develop framework for assessing open data initiatives in developing economies, [1] identified (in literature) six features of open data that are distinctly relevant to developing economies. These include participation, trust, equity, scrutiny, value amplifier, and flexibility. These intersect with the features of open data identified (in literature) by [11] in their study of how public sector information can have broader impacts (increasing democratic participation, promoting greater accountability, greater social cohesion, generating environmental benefits, identifying previously unknown links between different policy areas). [1] went on to categorise pathways along which open data impacts on development. These pathways include creating economic opportunities, helping to solve complex public problems, improving governance, and empowering citizens. Given the developing country context of this research, the pathways would be a good guideline to trace the impact of the City of Cape Town's open data initiative. Inception points, including events directly associated with the use of data from the city's open data portal, are identified, and the subsequent developments are traced along the pathways.

[1] 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. These premises could be used to identify and assign indicators of the extent of impact, and the metrics compiled could then be used quantify, or qualify, impact. This approach could also be merged with the Social Return On Investment (SROI) approach adapted by [2] to develop their open data Impact Monitoring Framework. For each data category/dataset, the framework 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 could then be arranged into the Impact Monitoring Framework in order to put the premises in perspective, in a structured and logical manner. This approach actually coincides with the Change Theory and/or Logic Model posited by [1]. Their theory/model states that *"Open data (supply), when analysed 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, empower citizens and users, create economic opportunity, and/or solve societal problems (impact)"* [1:8]. The theory/model also adopts the SROI approach, and is useful in qualitatively analysing and discussing the impact of open data in various sector specific contexts.

5 Research Approach

A phenomenological research approach is adopted, which is predominantly qualitative. The method uses relatively unstructured methods of data collection and places emphasis on inductive logic. Additionally, the method is particularly concerned with contextual description and analysis of phenomenon [14], which is essential for this research, given the implied need for contextual impact assessment. In this research vein, the method is applied in a cross sectional manner, with data collected for a “point” or a period in time, specifically the last three years. Data is collected from various sources including published papers, national and local government reports, commercial white papers, reports from supra-national and local non-government organisations, interest groups, news/press articles, blogs, and any other credible sources tracing the development of the open data initiatives in Cape Town. For the City of Cape Town, the impact of open data has evidently been minimally publicised, with no papers, reports, or news/press articles identified in this regard. What has gotten coverage, particularly in the press, has been the preceding events and plans related to workshops and hackathons related to open data. As such, mainly unstructured follow-up interviews with various stakeholders in the local open data ecosystem are used to collect more data for impact assessment.

The approach taken to measure the impact of the City of Cape Town’s open data initiative is thus be thematic and sector specific, adapting the frameworks discussed above. Specifically, this involves first identifying inception points for the direct uses of datasets from the city’s open data portal. Then, the subsequent developments directly attributable to the uses of the data are traced and analysed within the frameworks. The following sections discuss the inception points for the uses of datasets from the city’s portal that have been identified so far, and how the resultant impact are traced.

6 Critical and Theoretical Assessment

A constructivist epistemology is adopted. Constructivism essentially subscribes to the notion that truth and meaning are resultant from a subject’s interaction with the external world, thus subjects construct their own meaning (ergo meaning is constructed, not discovered) in varying manners in relation to the same phenomenon [14]. Open data has been quoted and motivated as a tool for facilitating positive social processes including government transparency, public participation and collaboration in governance, improvement of service delivery, complementing personal decisions such as farming practices to adopt or travelling itinerary to use, and several other social processes. The impact of open data is viewed as a constructed “meaning” relating to any of the various social processes meant to be impacted on by open data, and resultant from subjects’ interaction with the external world. Subjects are notably viewed as having aspirations when deciding to make use of open data in their interaction with the external world. Thus open data is construed as a facilitating agent in subjects’ interaction with the external world in different contexts, incepted by

various forms of aspiration. The associated aspirations are considered as social investments made with an eventual goal to realise meaning (the impact).

The theoretical perspective adopted is interpretivism, which asserts that natural reality and social reality are different, hence advocates for differences in method when attempting to understand either realities [14]. The particular interpretivist approach is phenomenology. The approach asserts that people's social experiences should be used in any attempt to understand a social reality, thus it is crucial to disregard any current understanding or preconceptions, and let phenomena speak for themselves to result in new meaning, fuller meaning, or renewed meaning [14]. This approach is justifiably appropriate, given how relatively new the concept of open data is, particularly in African contexts. In the developed countries in Europe and the Americas, in which the concepts of open data and open government data are relatively more mature, the meaning and promises of open data and open government data have been established (although not exhaustively). Often, it has been the case that these established meanings and promises have been used to motivate the need for open data initiatives in African contexts, and those that have been inceptioned have been expected to follow the trend previously assumed by the now more mature open data initiatives in the developed countries. Such expectations are justifiable, although not absolutely, given the obviously different contexts, most notably the different political climate in African contexts. Thus, a phenomenological approach seems appropriate here, in order to apply an inductive approach, in order to develop new, fuller, or renewed meaning of the social reality involving the use of open data.

Critical assessment of the achieved extent of meaning (impact) is then carried out using the SROI approach adapted by [2], which takes into account four different factors: input, output, outcome, and impact. Their open data Impact Monitoring Framework is used to analyse open data activities within the City of Cape Town, in retrospect, in a themed, and contextualised manner based on identified aspirations, and the eventual extent of impact.

7 Tracing the Development and Impact of Capetonian Open Data Initiatives

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. Thus, any developments and impact on communities resultant from activities such as these hackathons are traced and critically analysed.

The City of Cape Town's open data initiative has certainly gotten communities and organisations involved in the conversation and developments around open government data. Tracing the impact thus involves following up on the extent of achievement of the objectives set by the events and activities on Table 1. This

involves following up on the organisers of the events, finding out what ideas and developments were resultant of the initiatives, and finding ways to determine the extent of impact directly or indirectly facilitated by the inception of the City of Cape Town's Open Data Initiative. This is carried out along the identified pathways, and the enabling conditions and disabling factors are identified as well.

It is interesting to note that there have already been some current developments that can be attributed to the expected effects of open government data. One such relevant development is the case of the problems that have been faced by the Mayor of the City of Cape Town. Patricia De Lille has recently been criticised owing to speculations and reports from the office of the Auditor General which found inconsistencies about some tendering process for a transport tender, and renovations to the Mayor's private home using city funds [15]. Such matters would be clear to resolve if the city's open government data was truly open and such information would be available for the public to see [15]. Clearly, questions are being asked that have been motivated by the open government data concept, and this constitutes part of the intended impact of open data.

Using the framework suggested by [1], 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 open government data in the city. The objectives identified 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 the city of Cape Town.

8 Impact Findings

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. Impact is only possible when there is significant usage 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 seems 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 [16]. 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 [17]. 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 [18]. Impact in this regard may not be substantial given that it is confined to the students, but it does contribute towards creating a culture of critical data usage.

OpenUp 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 [19]. They also facilitate data usage by obtaining data from various sources (by means of downloading already available data, web scrapping, pdf scrapping, 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 [6, 20]. 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. [20] points out appreciation expressed by doctors for 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 [21]. 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 [19, 22].

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 draught that has affected the city since 2015 [18]. 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 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 [18].

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 [1]), 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 [18]. This facilitates a feedback loop, another specific impact factor within the ‘Culture and Expertise’ overall impact theme.

9 Critical impact assessment

The open data and Impact Monitoring Framework [2], 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 1 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 1. The open data Impact Monitoring Framework applied to Cape Town’s OD initiative

Data Category	Input <i>Native data, money, people, infrastructure, equipment etc.</i>	Output <i>Open data portal with metadata, updated content, open format etc.</i>	Outcome <i>Hackathons, apps, new firms, linking of data, research, etc.</i>	Impact <i>Intended and/or realised net effect of output intervention</i>
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	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

	medicine			
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 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 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 [18]. 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.

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 usage of information from their web applications [19]. Doctors express appreciation for savings made by their patients, whilst business personnel appreciate the ability to be able to keep track of their competitors. These are positive indications of impact, although the nature of how widespread the impact is cannot be definitively stated.

A relevant indicator of impact, or at least 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. [18] states that they (at the academy) only got 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 seems 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. There are no follow up articles, which would at least maintain the consistency of awareness around open data usage and resultant impact.

10 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 hardly on a subnational scale. 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 possibly 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.

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